QUESTION MARK

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EDITORIAL

SCIENCE is truly the greatest of them all. What other subject in man's universal knowledge lies there such truth, honesty, precision, and unbiased opinion? History, that is its written records, certainly lacks all of these, politics indeed so. What other factor has strived throughout the years to bring increased enlightenment to mankind, faltering only, when hindered by the intolerant superstition of man-made religious ethics? No one can honestly deny, unless fanatically ignorant, that no other factor has contributed more to humanity at large than science itself. Science states that black is black because any simple optical examination will prove it so. Dogmatic religion or dogmatic rule states that black is white because "*we* say it *is* so". Medieval science had difficulty in convincing man that ailments were due to physiological disorders, and not to inherent devils as was taught by medieval religion. The Church fought against the introduction by medical science of administering ether to women at childbirth on the grounds that "God's work" was being interfered with. Let them suffer their pains as God willed it so. How far advanced we would be at present if scientific teachings had not been delayed by human-conceived stupidities!

Even at present the contributions of science to humanity would be greatly increased were it not for the jealousies of men. Paul de Kruif continually laments the tragedy of scientific achievements going to waste because dogmatic and bigoted rule refuse to accept the benefits derived thereof. Such rulers fail to realize that medical science has presented its beneficial results with the object of aiding all mankind, and not only the privileged few. There are thousands of unnecessary deaths annually as de Kruif has so ably shown. Due to inefficiency of the state many well-advertized products are put on the market which contain harmful ingredients. Honest scientific analysis has proven this, but unfortunately Big Business is stronger than science. The tragedy is that millions of dollars are spent on worthless and harmful products, when there is a great need of increased and improved research facilities.

Many still bring up the age-old idea that science, besides its worthwhile endeavors, has brought destruction to many due to its recent developments of poison gas, speedy tanks, long-range artillery, and other playthings of war. Man produces conditions by which one mad soul desires world control and becomes such a threat to peace and security that he must naturally be stopped. People then blame science for its cruel inventions but never blame themselves for bringing about the necessity of such inventions. If science, instead of business, was allowed to apply its methods to human administration it would never have to waste its valuable time in construction of bigger and better bombs.

Science stands for light, for truth, for honesty. May everything be known! May the darkness of ignorance, superstition, intolerance, and hypocrisy, be blinded out by the shining figure of Science. May the beam of knowledge be thrown across the black curtain of unenlightenment! May the hand that bears the test-tube be held aloft, and in it the bigotry of the universe be decomposed and disintegrated! When that radiant day arrives when science will become supreme over present-day evils, mankind will throw off his shackles. The sheep will become the shepherd; the parrot, the owl. The mouse will be given eyes to see; the lion, cause to fear.

You Science Students

By WILLIAM LEACH, Ph.D., D.Sc.

IT was with mixed feelings that I accepted the invitation from the editor of the **Question Mark** to write what he called "A Message to the Science Students." What actually he meant by a message was not very clear to me at the time and whenever I have thought about it since, it has been less and less clear. One needs Divine inspiration before one can begin writing messages and candidly, I feel anything but inspired these days. I think, therefore, that the best course to follow is to drop this message idea. Instead, I propose to raise one or two points that have occurred to me from time to time.

In my frantic efforts to gain ideas for this article I read the extremely interesting account, published in the **Question Mark** this time last year by Dean Armes, entitled "Science and the University." In this is described the remarkable advances that have been made by our university since its inauguration some thirty years ago and in particular the growth of the science departments. I would recommend all who have not read it to do so. I think that I may here assert that this advance has, if anything, gained momentum during the last three years, especially in the field of scientific research.

Now the question that arises is, are you taking full advantage of these changes? One thing that strikes a person like myself, coming to Manitoba from university life in England, is the fact that students here seem to have difficulty in getting away from high school ideas. When you came up to the University, you find conditions very different from what you were accustomed to at school. In the first place you have a considerable amount of choice regarding the subjects of your curriculum, and what is more important still, you are not compelled to study. The secret of successful study is interest, you must become interested in a subject if you wish to really master it, without interest it is mere drudgery. Unfortunately, you will say, we have the curse of examinations. I maintain, however, that examinations are the least important events in university life; you choose a course presumably because you are interested in it or feel that you need to be, you have got to be if you hope to gain any knowledge of it. If you obtain the knowledge, then as a matter of course you pass the examination. I fear that without the knowledge, no amount of cunning in writing your examination will get you safely past the examiner.

One thing that strikes me when I think over my own student days, is the extraordinarily keen interest we had in our subjects. We did not merely confine our attention to the prescribed course work. We read widely and we managed to secure extra time in the laboratories in order to carry on little investigations on the side. In other words of science afforded us no end of fun. We were curious about the research that was being carried on around us and made it our business to find out what it was all about, and we gained lots of ideas and a good deal of inspiration in the process. I assure you, if you go through your university life and do not feel some kind of deep enthusiasm over one of your subjects, you are missing a great deal. As you grow older, you become sophisticated and take science like most other things, for granted; you can never recapture the thrill of your early probings into the unknown. Take my advice, therefore, if you have any real interest in science, follow it up for all you are worth, now. Risk the scowls of the research workers whose

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Gas Warfare:

A Thing of the Past, or a Threat of the Future?

By F. D. WHITE.

TWENTY-TWO years an Armistice was signed, hostilities ceased, and the "War to end Wars" was over. A few years passed and doubts began to arise; speculations appeared in print as to the character of the "Next War." The writers of these books and articles were actuated by different motives; some were frankly pacifists who thought that piling horror upon horror they could paint such a picture as would deter their country from ever again having recourse to arms; others with academic detachment endeavoured by considering the experiences of the last war in the light of modern inventions, to forecast the probable results; a few, sufficiently astute as to correctly interpret the trend of international diplomacy, sought to warn us of the dangers into which we were drifting. In most of these forecasts the subject of gas warfare bulked largely, and this was quite reasonable because from its introduction in April, 1915, until the end of hostilities, gas had proved quite an efficient weapon. Moreover, these three and one-half years had been mostly experimental, and it would be idle to pretend that either side had achieved maximum efficiency in the use of what was freely referred to as a new arm of the Service. We were therefore treated to some very lurid accounts of the havoc we might expect from the gas attack of the future, by writers, the vividness of whose imaginations was only equalled by their lack of scientific knowledge.

F. D. White
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Although such alarmist statements as—"One single bomb filled with modern asphyxiant gas gas dropped, say, on Piccadilly Circus would kill everybody in an area from Regent's Park to the Thames," and again—"With the aid of 'Lewisite,' the most deadly poison gas yet produced, London's population could be choked to death in three hours,"—were manifestly absurd, it was difficult to counteract their effect upon the average individual, since responsible authorities freely admitted that gas attacks, not only upon the armed forces but by means of aircraft, upon the civilian population might possibly be a feature of the next war. It was considered unlikely that any **new** gas would be used, i.e., any chemical substance whose poisonous properties would take us unawares without some means of protection, but on the other hand it was possible that new and more efficient means of projection of the known was gases might considerably enhance their effectiveness.

As a first line of defence we had the Geneva Protocol of 1925 outlawing the use of gas in war, and signed by representatives of all the leading European nations, but as recent history has shown that, in the case of certain nations, the signature to a "scrap of paper" does not weigh very heavily against material advantages, measures had to be taken. No vulnerable nation dared remain unprotected against even the remote possibility of a gas attack, and accordingly respirators were manufactured for the civilians, gas-proof rooms and dugouts were prepared, A.R.P. services were instituted, and squads were drilled in measures to be taken against the possible contamination of areas by mustard gas. Such was the position during the years of uneasy peace which saw the aggressiveness of the dictator nations growing, as the democracies pursued their ill-starred policy of appeasement. It seemed inevitable that sooner or later war must come, and with it gas attacks on a much vaster scale than anything hitherto attempted.

Fourteen months ago the second world war started and up to date there has been no recourse made to the gas weapon. Moreover during the years when we were at peace, China was invaded by Japan, Italy

conquered Ethiopia and Albania, while the Spanish Civil War furnished the laboratory in which the Dictators tested and experimented with this most modern engine of destruction. Only in the Ethiopian campaign was any use made of gas. Why is this? Have we once again been misled by so-called experts, and have all our anti-gas precautions been so much wasted effort? I do not think so, but to answer these questions one must take into account certain considerations. During the last war, from the Battle of the Marne until August, 1918, the condition was static; the belligerents faced one another in two long lines stretching from the North Sea to the borders of Switzerland. Gas was introduced as a means of breaching the line and converting static warfare into a war of movement. The German **blitzkrieg** is a war of movement, and so long as its momentum can be mantained the use of gas is unnecessary. This momentum was maintained, and the result was the collapse of France. As things are at present the land war is once again static, but this time the armies are separated by the English Channel, a barrier which cannot be bridged by gas, unless through the medium of aircraft. Now to be effective gas bombing from the air must be directed against masses of troops, or civilians as the case may be, and requires the use of heavy bombers or large transport planes in mass formation. This again necessitates full command of the air, and as far as Britain is concerned, this is a condition which the Germans are farther than ever from attaining. Moveover, gas bombs dropped upon a city cannot possibly cause as many casualties as the same weight of high explosive, **provided** the population is well supplied with respirators, gas-proof dugouts, and other means of protection. Another deterrant is the threat of reprisals in kind, but this is unlikely to weigh heavily with Dictators who see the possibility of delivering a crushing blow before the enemy can mobilize his resources for retaliation.

It has frequently been asked why gas played no part in the warefare in Spain. J. B. S. Haldane points out that the country districts were sparsely populated and therefore did not furnish good targets, whilst in the heavily populated cities of Barcelona and Madrid, to lay down a concentration of any gas sufficient to penetrate houses and cause casualties on a large scale, would have required the practically simultaneous liberation of such enormous quantities of the toxic compound, as to render the scheme impracticable with the resources at Franco's command. Further, a very much smaller number of bombers, flying in relays, could drop high-explosive bombs, with just as destructive an effect to life ,and vastly more to property.

Mustard gas **was** used by the Italians in their Ethiopian campaign, both in the form of aerial bombs, and of spray, but there the conditions were entirely favourable. The Ethiopians had no aircraft or anti-aircraft batteries, so the invaders were able to fly over the country at will, and close enough to the ground to make the spraying of liquid mustard gas perfectly feasible. Worse than that, these unfortunate people had not even the most elementary form of respirators or protective clothing, while what footwear they possessed (and the majority wore none) was of no protection against contaminated ground. There is good reason to believe that the use of mustard gas was one of the chief factors which led to the rapid occupation of the country.

From these considerations I would be inclined to the view that gas warfare is a thing of the past only in so far as the conditions under which it was successfully used, are things of the past. Under present conditions it is difficult to see what advantage coul d be gained by the introduction of gas warfare. Sporadic raids, more of a nuisance than military value, might be attempted; even large scale attacks might be tried with the object of terrorizing the civilian population, but the morale of a people which has withstood, night after night, the ferocity of high-explosive and incendiary bombing, is unlikely to be affected by the substitution of gas. However, conditions will undoubtedly change; we shall not always remain on the defensive, and should tactical considerations warrant it, it is quite possible that the enemy will once again use gas in some form. One should not forget that the most effective battle gas hitherto used, the so-called mustard "gas," is a persistent liquid, and hence a more valuable defensive than offensive weapon; if used in sufficient quantity it could be calculated to slow up an advance, even of mechanized forces, by contaminating the ground over which the attackers must advance. Actually its use by an attacking force is limited to preventing the enemy from bringing up reinforcements from the flanks, as it cannot be used on the front over which the attackers hope to pass.

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Neurotic Animals

PETER HAMPTON,
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TO most people the year 1914 is significant because of its association with the last World War; to psychologists 1914 is significant for another reason. It is the year in which Shenger-Krestovnikova, one of the great Russian physiologist Pavlov's associates, stumbled on experimental neurosis.

Shenger-Krestovnikova, like so many other enthusiastic followers of Pavlov, was intent on making her contribution to the ever growing discoveries about conditioning. She knew a great deal concerning the fundamental process of conditioning. For instance, it had been proven by her and other members of Pavlov's staff, that while, logically speaking, a response can be evoked only by a biologically adequate stimulus, practically speaking, a response can be evoked by a stimulus which is presented to the subject at the same time as the biologically adequate stimulus until, eventually it can be used as a substitute stimulus. The subject endows the stimuli present, when the biologically adequate stimulus is presented, with the power to evoke the adequate response taken even when the biologically adequate stimulus is taken away.

Peter Hampton

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Thus, for example, when the experimenter presents food to a hungry dog, saliva will flow in its mouth. In this case the food is the biologically adequate stimulus which produces the biological response, the flow of saliva in the animal's mouth. But supposing the experimenter introduces another stimulus, the ringing of a bell, whenever he feeds the dog, and then eventually only rings the bell and does not feed the animal at all, what will happen? The sound of the bell will take over the power of the stimulus of "food" and will by itself evoke the response "flow of saliva." The sound of the bell has thus become a substitute stimulus for food and brings forth the proper response of salivation just as if the food were actually present. This procedure is called conditioning. Pavlov, in whose laboratory Shenger-Krestovnikova worked, had taught her all about this fundamental process of conditioning. Shenger-Krestovnikova, however, was not satisfied with this knowledge. She wanted to know to what extent an animal can discriminate between two very similar stimuli. In other words, she wanted to know how nearly alike two stimuli must be before the animal fails to discriminate between them.

In order to find out about this, Shenger-Krestovnikova performed the following experiment: A dog was trained by conditioning to salivate whenever an illuminated circle was presented on a screen. When the dog had learned to respond to this stimulus, an ellipse was projected on the screen. The ratio between the semi-axes of the ellipse and the circle was 1:2. The animal was now trained to discriminate between the circle and the ellipse, and was taught to respond by salivating only to the circle. As the experiment proceeded the shape of the ellipse was gradually approximated to that of the circle. The animal succeeded time and again in distinguishing between the two geometric figures until the ratio of the semi-axes of the ellipse and the circle became only 8:9. When this ratio was approached, the dog was unable to discriminate between ellipse and circle. Three weeks of steady drilling brought absolutely no further results. As a matter of fact, the dog became worse in his discriminations.

The results of this experiment gave a satisfactory answer to Shenger-Krestovnikova's queries, but when she noticed the strange behavior of the dog she had used for experimental purposes, her interest in the original problem gave way to a study of what subsequently came to be known as experimental neurosis. The animal exhibited all the symptoms of acute neurosis. Where it previously had been quite docile in undergoing the experimental proceedings,

it now became restless, wriggled about in its harness, howled, and barked loudly. The experimental paraphernalia such as the apparatus for mechanical stimulation of the skin, the tubes connecting the animal's room with that of the observer, were now viciously attacked by the dog. Any further experimentation with this particular dog became impossible. The dog had undergone a nervous collapse in its attempt to discriminate between a circle and an ellipse with a ratio of only 9:8 between the semi-axes of these geometric figures. A changed environment finally brought the dog around to its former self.

The discovery of experimental neurosis was thus an accident, an accident, however, which was to provide the field of psychopathology with another valuable method for diagnosis and treatment of neurotic ailments, that of conditioning. By means of conditioning, experimental neurosis could henceforth be set up and studied, and the observations and information obtained, applied to read neurotics. Since these experimental states of neuroses are more or less controllable and can be terminated at will by removing the animal from the experimental environment, they have proved a real boon to the study of symptoms of neurosis in human beings.

Not much was heard about experimental neurosis during the war years and the immediate post-war years. But of late, experimental neurosis has been induced into dogs, sheep, pigs, rats, mice, cats, birds and even human beings. In 1936 at Johns Hopkins University, W. H. Gantt repeated the experiment performed by Shenger-Krestovnikova in 1914 and obtained much the same results. Gantt induced neurosis into dogs by a pitch discrimination experiment. He found that when the tones which the dogs were to discriminate were brought very close together, the animals began to show symptoms of abnormal behavior. They whined, barked, were extremely restless, and on occasion refused to touch the food given them. Two of the dogs studied over a lengthy period lost their neurotic behavior when they were given extensive rest periods between experiments. The third dog, however, developed a fairly extended neurosis and could therefore no longer be used for experimentation. But even this dog resumed its normal behavior when it was put into a new environment. The only time that the dog exhibited signs of abnormal behavior in the new environment was when it heard tones in a pitch approximating very closely the pure tones between which it had been promted to discriminate in the experimental situation. Then it began to whimper, refused to eat, and tried to escape from the presence of the trainer.

Ten years earlier H. S. Liddell and his associates at Cornell University, succeeded in producing neurosis in sheep. Liddell used a number of methods to accomplish his ends. The method found most effective was again that of discrimination. Liddell prompted the sheep he was experimenting with to differentiate between different rates of beating metronome. These rates were made more and more alike, until the sheep were unable to differentiate between them and became neurotic. The behavior of the sheep was then carefully observed and compared with that of normal sheep. It was found (1) that the neurotic sheep feared the laboratory and put up a great deal of resistance when the experimenter attempted to lead them from the barn to the laboratory. (2) When the sheep were brought to the laboratory and placed in the experimental harness in spite of their resistance, they showed an extreme degree of hyper-irritability and moved about in the harness constantly. That this movement was not entirely voluntary is attested to by the fact that involuntary, tic-like movements and twitchings were observed in the left foreleg where the electrodes are fastened in the experimental set-up. Respiration was also very irregular, accompanied by sudden jerking and starts of the body. (3) The sheep were now found to respond to inappropriate, negatively conditioned stimuli, and had apparently lost the ability to delay a conditioned response. (4) Drugging the sheep produced peculiarly abnormal effects. For instance, the drug epinephrine, when injected into these neurotic sheep caused the animals to exhibit more vigor in their responding movements when the "get ready" signal to a stimulus was given, than when the stimulus itself was presented. On the other hand, during the rest period that folling the rest period that followed, the sheep began to react very vigorously with their limbs. The drug cortin seemed to have the opposite effect of epinephrine on the animals. The pulse rate of these neurotic animals was also very much increased when the conditioning stimulus was given, and continued to be rapid after the experiment was over. All these symptoms of behavior are absent in the behavior of narmol sheep.

In the case of these sheep, the neurotic behavior continued to some extent after they

had been removed from the laboratory to a new environment. Pulse and respiration remained irregular, and there were many indications that the sheep were still much more restless than normal sheep. The periodic variations of activity and rest were also upset. While the normal sheep is active during the day, it is quiet and at rest during the night. These sheep, however, continued in a state of unrest and excitement at night. The only decided change in the direction of normal behavior came when the sheep were completely removed from the laboratory and the experimental situation. The normal variations of activity and rest returned, and the pulse and respiration also became more normal.

Beginning his work with five sheep, Liddell has kept up his observations to the present day. One of these animals died last year after having been in a neurotic state for nine years. Two of the sheep remained neurotic for six years. In every case these animals appeared and were, as far as the experimenter could make out, normal when away from the laboratory, but as soon as they were put back into the experimental situation, they lapsed into a state of abnormality, with all the previous symptoms of over-reaction, increased respiration and pulse, and irregularities of activity and rest reappearing.

Two years ago, G. F. Sutherland succeeded in inducing neurosis into a pig. Before much could be done with the pig, it had to be trained to stand still when put into the experimental harness. At first, shortly after the pig was weaned, the experimenter taught the animal to walk quietly at the end of a rope. Next the pig was taught to come to a box and nose its way up the lid to receive food, which consisted of small pieces of apple. When this could be done satisfactorily, the experimental harness was put on the pig, the electrode attached to its foreleg, and the current put on intermittently. The pig had by this time associated the box with food, and although the electric shocks caused flexion in the pig's foreleg, more than a hundred combinations with a tone failed to bring about a conditioned flexion. The pig continued to come to the box for food. Undismayed, the experimenter proceeded to make the experimental situation more complicated. On one day the pig was fed and on the other shocked. This alternate feeding and shocking was kept up for a considerable time. Preceding the shocking and the feeding discriminable tones were sounded. The behavior of the pig now became decidedly restless. It was especially upset on shocking days. On feeding days it was not as restless, but was still far from normal. In order to reduce the tension between tests, the pig devoted much time to opening and closing the lid of the box. The behavior succeeded in reducing the tension for the pig some, what, although the situation was constantly becoming more and more unbearable. Still, at this stage of the proceedings the pig could not as yet be called neurotic.

The next stage in the experiment introduced a new problem. The pig was forced to make a decision, a decision as to whether it should open the lid to the food box and perhaps obtain food, or open the lid and perhaps receive a shock. This choice entailed too much of a conflict and the pig broke down and became neurotic. On occasion it still opened the lid of the food box, but this action was impulsive. In between tests the experimenter could now put an apple on the pig's snout and the animal would not remove it. These periods of immobility which the pig developed, lasted at times as long as an hour. The pig also behaved differently when it was released from the laboratory environment and put into a pig pen with other normal pigs. The neurotic pig was quarrelsome, picked fights with the other pigs, and on several occasions attacked the attendant at feeding time. Then there were periods when it seemed to be deeply melancholic. It would retire to a corner of the pig pen and sink into an impenetrable stupor. Eventually, however, it was brought back to normalcy in its new environment.

For a long time all efforts to produce experimental neurosis in the rat failed. This apparently was largely due to the fact that the rat manages to go on working under circumstances which prove too difficult for other animals. The rat is tough in this respect, and it was only when this was realized that investigators succeeded in putting the animal into a neurotic state, with the result that in the last year at least four separate successful inductions of experimental neurosis into rats have been reported by Cook, Maier, the Morgans, and Humphrey and Marcuse.

Cook employed the following experimental set-up in his investigation: An experimental harness was put on six rats. The harness was fastened over the animals in such a way that the only free movement possible was a flexion of the right foreleg. At times this flexion was rewarded with a food pellet; at

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Profitless Discussion of a Stale Topic

"The biggest zoological problem in Manitoba is that of getting a skunk from under a granary."

Considered opinion of a Manitoba Master-farmer.

IT is an open question whether Science should be regarded as a sport, a trade or an art. Among students of science there is a superst tion that some knowledge of science is an essential ingredient of an expensive education and some would even go so far as to affirm that a scientific man, because he can explain why bathroom washbasins go crusty, or where flies go in December, or some such mumbo jumbo, is a cut above the unfortunate wretch who has to go through life merely with a chesterfieldian vocabulary, a ready familiarity with the literature of several languages, and an ability to express his ideas in faultless English.

Now, on the other hand it is undeniable that contact with the exponents of the Humanities and exposure to the elements of literature, world history, philosophy, all that sort of thing, does give the science student a veneer of culture, micrometrical though it may be. On the other hand, it is undeniable that a man can be a competent analytical chemist or systematic biologist or field geologist and have no more culture than a side show barker. I do not know whether any attempt has been made to train the higher Primates in the art of using a balance or turning the handle of a microtome, but there seems to be no concrete reason why such an attempt should not be successful. If that should happen, there will doubtless be many people willing to place the ingenious anthropoid on a higher pinnacle of Parnassus than they would place Mr. George Bernard Shaw.

In view of the rapid evolution into technical vocations of all fields of science, even of those biological sciences whose proud boast used to be that they were of no use to anybody, it ill becomes the present day scientist to stand upon the battlements of an ivory tower and bray about the idealism of pure science and the scientific method. An aloofness from the mundane affairs of modern society is pardonable in the artist, the poet, the philosopher, the literary man; in the scientist it is as unforgivable as it would be in the corner plumber, for he is merely a man who has been expensively trained to put his eyes and thumbs at the service of the general public.

The science student should walk humbly in the presence of his Arts Faculty betters. For all he knows, we may be on the verge of a modern Renaissance in which the universities will revert to the rigid scholasticism of mediaeval Oxford and Padua, and will kick him into the machine shops and technical schools where he rightly belongs.

The best thing that could happen to him would be for the followers of the Humanities to get together and say: "Now, look here, my lad, we are not going to tolerate you around here, dropping your aspirates and splitting your infinities and amusing yourself with a lot of brassware and glassware like a baboon with a bunch of cocoanuts; you will have to come into line and learn something of the beauties of the classics. the majesty of history, the profundities of philosophy, before we let you loose to practise your soul-sickening monkeyshines."

Then on the Day of Judgment, when so many of us are found wanting, somewhere about the middle of May, that grim arbiter, the Dean of Arts and Science, will utter the solemn words: "Stand up those candidates for the degree of Bachelor of Arts'," and we will see rising from the serried ranks of intelligentsia the shining faces of the chemists and biologists of the future, eager to come forward and receive, amidst the plaudits of the assembled multitude, the coveted accolade of the white rabbit skin.

ZOOLOGICUS.

Science and Politics--More Particularly State Medicine

By HUGH McD. CLOKIE, Assoc. Prof. of Government.

WHEN I was asked to write a few words on the relation of science to politics it was suggested that special reference be made to that topic which is so much in the public mind today, namely, socialized medicinse. I am glad to have this opportunity because the subject raises a number of questions which will have to be faced increasingly in the future. At the start, however, it is proper to explain what my position is in controversies of this kind. It is no part of the duty or function of a political scientist to take sides. When he does so on a matter of public policy, he is really assuming the role of moralist or politician. The student of politics is concerned with examining the nature of governmental activities in order advice on the ground such and to find out what happens, how moment one commences giving it happens, and why. The such a line of policy is good or bad, one has left the realm of political science and entered that of ethics and political philosophy and become a politician, reformer or partisan. Let us first look at the subiect with the impartial view of a scientific student in order to inquire about the significance and possible consequences of State control of Medicine. This is certainly a study worth cultivating because as we well know the whole matter is warped and distorted in common discussion by class prejudices, vested interests, and professional and anti-professional biases.

The subject of state medicine is indeed an important one, and since it is the policy of the Question Mark this year, to show how scientific methods can be applied to social life and administration to the best interests of all humanity, it was desired to present a discussion upon this topic. The worst place in which the profit system can be applied, is in the medical profession. Under the present medical system there are too many social doctors to administer to the wiles of imaginative women, and not enough of the true medical man to assist the deserving.

One of the most widely circulated objections to State Medicine is the assertion that State control means gagging the free pursuits of medical science. If this were true it would be a very serious objection, for we may assume that in this scientific age any restriction on scientific investigation is detrimental to the State. (This, it must be observed, is an assumption of policy —but we cannot argue everything at once, and few openly deny this assumption. For a number of years I lived in an Atlantic Coast State in which dissection of the human body was forbidden by law. The result was that that particular State was a scientific parasite, for although it had universities it had no medical school and students could not even possess a set of 'bones"). But does State Medicine imply control of science? The answer depends on the question physicians and surgeons are scientists. Generally speaking —though I know this may bring down a storm on my head—I think it will be true to say that they are what they are termed, medical practitioners, that is, they are applying, wisely and efficiently, rules they have learnt from the scientists. Very few practitioners have the time, opportunity, capacity, or training for the serious work of scientific investigation. In the exceptional cases where a medical man does combine the art of healing with systematic research he is pursuing two callings at once, applied science and pure science. This combination is a very effective and fertile one in medicine, but it is employed chiefly by the teaching-researcher and not by the ordinary practitioner. In any case, the great body of advance in medical knowledge is being made by institutionalized study—in hospitals, schools, research institutes. Let us leave the practitioner out for a moment.

Will State Medicine affect the pure scientist? It may do so, but it does not have to. If socialized medicine meant that the State would declare what may be studied and taught in the scientific schools, then obviously this would be another aspect of political regimentation. There are States which forbid the teaching of evolution, impose special instruction (in the elementary schools) respecting designated drugs and narcotics (without defining the terms), and ban vivisection. This approaches the ludicrous and tragic insistence by the Communists on the inheritance of acquired characters and by the Nazis on racial doctrines.

But this has nothing to do with State Medicine. It may accompany it as a part of increasing totalitarianism. The American States which have been greatest offenders against free science have not been the leaders in socialized public health services. If it is suggested that State Medicine is the entering wedge for full State control of medical science, it should be remembered that we have long had public education and State Universities without succeeding in making everyone think alike and without making University scientists toe the line. Of course, there is always a danger of this control being exercised; but the remedy is not the withdrawal of public support of education and universities, but the watchful guard maintained by those who perceive the value of free investigation. So far as freedom in science is concerned, then, one must conclude that the entrance of the State upon a new medical policy holds no greater peril for medical science than public education held for the study of history, economics, chemistry, etc., in the past.

Let us go back now to the general practitioner. Here it must be admitted at the very start that the picture is quite different, both in the essential purpose of State Medicine and in its observed consequences where it has been introduced. The usual objections to the customary forms of socialized medicine are that it destroys the freedom of the practitioner by practically telling him what he has to do and when to do it, that it undermines the historic professional relationship of the physician and patient by creating and restricting artificially his clientel, and that in consequence it removes the incentive to good practice by equalizing rewards. The fact that these criticisms are thought to reflect the special interests of a profession should not blind us to their social significance. Although two of them — independence and income—evidently display some self-interest, they do affect the public, which has a definite interest in keeping the profession attractive to ambitious and enterprising men. Another of them, the practitioner-patient relationship, is clearly of wide social importance.

Now it may be agreed in the beginning that any of the usual forms of socialized medicine do work a very considerable change in the condition of the medical profession. Up to the present the practitioner has placed his skill and knowledge at the service of those who come to him, usually of their own choice and with the requisite fee. With certain ranges the practitioner may have a specialized practice or a general one; he may have wealthy patients or poor ones; his talent may lie in the beside manner or in more definite skill in surgery or healing The extent of his grauitous work will depend on his generosity, means, opportunity and activity. Any scheme of socialized medicine is going to work profound changes in these matters. It is unnecessary to enlarge upon the subject of panels, group health insurance, community health centres and such like. Their ultimate effect is to increase the number of people under medical care but to reduce the amount of unpaid voluntary work, to equalize generally the distribution of patients between practitioners while at the same time tending to redistribute practitioners over the country, and to remove the extremes of highly profitable and exceptionally unprofitable practices. Thus, however limited the first forms of socialized medicine, if they are carried out with the completeness which may be expected, the consequences for the profession are enormous.

The reasons advanced for the State entering upon this new development do not need to be discussed, for they have been thoroughly canvassed during the past twenty years. It may be taken for granted that private practice has not succeeded, as yet, in providing for the community that degree of medical and surgical attention which is popularly regarded as proper in this day and age. As a matter of social politics one may say frankly that the medical profession is fighting a losing battle in resisting the introduction of socialized medicinc, for nowhere have the individualists proposed any system or reform which appears to offer the public what it desires and feels is within its grasp. The germ theory of disease has taught the public that contagion is a social problem. The study of dietetics has created a feeling of public responsibility for child welfare. The recognition of occupational hazards has fostered the belief that individual health and physical well being are products of a good social environment. The growth of community self-consciousness in matters of health is a factor which must be given due weight. The impartial observer does not need to express an opinion about the merits of the many new social policies and expectations. But one must accept as a fact the social demand for greater public health care.

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God and the Scientists

By LEO MOSER

A RECENT address by Professor Albert Einstein, provoked a storm of controversy. In this speech, read at a conference on Science, Philosophy and Religion, Einstein urged the abandonment of the "concept of a personal God." "To be sure," said Einstein, "the doctrine of a personal God interferring with natural events could never be refuted in the real sense by science, for this doctrine can always take refuge in those domains in which scientific knowledge has not yet been able to set foot. But I am persuaded that such behavior on the part of the representatives of religion would not only be unworthy but also fatal. For a doctrine which is able to maintain itself not in clear light, but only in the dark, will of necessity lose its effect on mankind with incalculable harm to human progress."

Leo Moser
Leo is another Third Year Science man, and is also another graduate of St. John's High School. Leo has given us a review of scientific thought upon the viewpoint of religion.

This rather unexpected outburst on the part of a scientist of such high rank again brings to the foreground the important question: "What is the attitude of the contemporary scientist towards the concept of a God and towards religion in general.

In 1934 a questionnaire was circulated among 2,300 American scientist (Harpers' Magazine August 1939). They were asked to accept on of the following statements:

A. I believe in a God to whom one may pray in the expectation of receiving an answer. By "answer" I mean more than the natural subjective psychological effect of prayer.

B. I do not believe in a God as defined above.

C. I have no definite belief regarding this question.

Of those that answered (75%), 30% accepted A, 56% accepted B, and 14% accepted C.

This result is, of course, not conclusive, but suggests that the theism of American scientists is rather sparse.

In their attitude towards religion outstanding scientists who have definite opinions on the subject seem to fall mainly within three catagories. The first support traditional religion and religious institutions. The second formulate Gods to suit their tastes as well as their equations. The third group is that in open conflict with religious theories and institutions.

The number of supporters of traditional religion among scientists is by no means small. Professor Andrew Millikan whose research on the structure of the atom earned him a Nobel prize, is an outstanding member of this group. Dr. Millikan devotes much time and effort in support of American church life. Millikan's faith in the Christian religion is so robust and so independent of the outcome of physical speculations that he concludes that other phsysicists are in the same position.

"Eighteenth and Nineteenth Century materialism," he proclaims, "never had any lure for him, (i.e., the physcist, for it always represented quite as pure dogmatism—assertiveness without knowledge — as did medieval theology, and modern developments have pushed it completely out of sight." Millikan claims that the contradictions brought about by religious faith are not any worse than the contradictions which physicists have had a put up with in physics alone.

The exact position of the second class typified by the physicist Sir Arthur Eddington is more difficult to understand. He, along with other masters of the new physics attempt to erect Gods which are in complete harmony with their physical theories. The theory of Relativity, and, to an even greater extent, the Quantum theory have caused great upheavals in traditional physics. These upheavals have had heavy repercussions in the philosophic field. Eddington has written numerous books and articles on the philosophic implications of the latest

scientific discoveries. The attempts to reconcile free will with the theory of indeterminacy. It seems, however, that the God Eddington has in mind has little in common with the personal Deity of traditional religions.

Sir James Jeans, the renowned astronomer, is another outstanding member of this group. Jeans too, attempts to bridge the gap between science and religion. He sets forth the theory that the universe was created by a mathematician and it consists of the thoughts of this super-mathematician—that the universe is in fact "God's pure thought" whatever that many mean. Jeans believes that "the controlling mind (God) has in common with our own individual minds only the ability to think mathematically." Emotion, morality and aesthetic appreciation have no connection with this God, it seems.

Max Plank, of Quantum theory fame, has himself written on the philosophic implications of his theory, but he is less ready to commit himself than many of his associates.

It is the irreligious group of scientists which has been getting the bulk of the publicity lately. While it is Einstein who has been the latest to bring attention to their ranks he has been, until now, one of the least offensive of this group. This, although he has on a previous occasion declared, "I cannot imagine a God who rewards and punishes the objects of his creation. Neither can I believe that the individual survives the death of his body although feeble souls harbor such thoughts through fear or ridiculous egotism."

Several months ago the views of Bertrand Russel, the eminent English mathematician and philosopher, were given much prominence. Russel, who has done extremely important work in the philosophy of mathematics was appoint to lecture at City College in New York. He was then prevented, by court action, from taking this post on account of his radical views on religion and morals. In one of his many essays Russel writes. "At the age of 18 I definitely abandoned all the dogmas of Christianity, and, to my surprise I found hyself much happier than while I had been struggling to retain some sort of theological belief.

Regarding the relation between science and morals he writes: "While it is true that science cannot decide questions of value that is because they cannot be intelligently decided at all, and lie outside the realm of truth and falsehood. Whatever knowledge is attainable, must be attained by scientific methods; and what science cannot discover, mankind cannot know." Not content with his own skeptisism Russel pours ridicule on those scientists who attempt to justify religious beliefs on scientific grounds.

Lancelot Hoghen, a prominent English biologist and author of the best selling "Mathematics for the Million," writes on the same subject: "The apologist attitude so prevalent in science today is definitely not a logical outcome of the introduction of new concepts into physics."

Julian Huxley, another well known English biologist expresses his views on the problem of God in this short but defnite statement: "I do not believe in the existence of a God or Gods."

J. B. S. Haldane, still another top-ranking biologist and mathematician, who gave a series of anti-church lectures on the B.B.C. expresses his views thus: "The Churches are half-empty today because their creeds are full of obsolete sciences and their ethical code suited to a social organism for simpler than that of today."

Sir Arthur Keith, foremost living anthropologist, states: "Certainly the creative power which is at work bears no resemblance to the personal God postulated by the Hebrews."

Naturally, for an accurate picture of the attitude of the scientists the views of many more must be gone into. Also they must be examined in far greater detail than has been done here. Nevertheless, I think, several conclusions may safely by drawn from what has already been said.

In the first place—although the attitudes of scientists towards the concept of a God and towards religion in general may be roughly classed into three groups, still, there are really just about as many shades of opinion as there are scientists. Secondly, no one group seems to have a distinct majority either in number or in weight of opinion. Thirdly, in view of this disagreement among scientists, who as a group cas usually arrive at the same general conclusions in scientific matters, it is right to conclude that neither the existence or non-existence of any particular type of Deity, nor indeed, any of the major premises of religion, have been brought under the strong light of scientific method. Whether this must remain to be the case is naturally open to speculation.

Science and Philosophy

RUPERT C. LODGE

SCIENCE, "ordered knowledge of natural phenomena and the relations between them," is a highly complex phenomenon. It is produced by the co-operation of trained specialists, using their senses and instruments which amplify the power of the senses, employing experimental techniques which control the conditions under which phenomena and their inter-relations are studied, applying (wherever possible) careful measurement ment and exact quantitative formulation of results, constructing and elaborating hypothetical principle of explantion, deducing the logical consequences implicit in such hypotheses, and verifying, by further reference to sensory observation, the consequences so deduced: continuing these processes until the hypotheses suggested by the constructive imagination are reduced (if possible) to a single, adequately verified, hypothesis.

Rupert Clendon Lodge professor of Logic and philosophy, University of Manitoba. Universities in which he lectured include Manchester, Dalhousie, Alberta, Minnesota. Arrived in University of Manitoba in 1920.

Philosophy, "critical reflection in general," is less complex than science. It uses, for the most part, neither direct sensory observation nor instruments which amplify the power of the senses. Its experiments (such as they are) are "dialectical" and have no immediate reference to the factual observation of phenomena and their inter-relations. It seldom has occasion to use either measurement or quantitative techniques; and its attempts at verification are half-hearted and seldom pushed home. Its hypotheses are usually alternatives, and there is little hope of ever reducing them to a single, adequately verified, principle. It is in the imaginative construction of hypotheses of wide range, in the dialectical elaboration of their presuppositions and consequences by means of logical techniques, that philosophy especially consists; and its criterion is rational consistency, rather than correspondence with observed fact. This is sometimes expressed by calling philosophy "rational," "systematic," and "speculative."

How are science and philosophy related to one another? In part their fields, as well as their methods, are distinct. The field of science is a restricted field. It deals primarily with **natural** phenomena, considered as such. Phenomena which are primarily considered as something else, and only secondarily as facts occurring in the space-time world, fall (to precisely that extent) outside the field of natural science. **Social** phenomena, for instance, such as the culture-products known as "art," "science," "social ideals," "religion," and "philosophy," and such as all 'value-judgments," fall (for the most part) outside the field of natural science. It is theoretically possible to observe, classify, inter-relate, and, to a certain extent, explain such phenomena as facts occurring in space and time. Sociologists devote a part of their efforts to this task. But it is felt that such fact-finding is merely preliminary to a different kind of explanation; and it is usual to leave that different kind of explanation to the philosophers, whose "critical reflection" is not restricted to studying the space-time aspect aspect of social phenomena. Esthetics, epistemology, ethics, and metaphysics occupy this field which is deliberately and by a kind of gentlemen's agreement handed over to the philosophers.

The field thus conceded to philosophy is sometimes called the territory of "mind," and a sharp line is drawn between the "philosophy of mind," and the study of natural phenomena, which the scientist claims as his own. The gentlemen's agreement is intended to work both ways. The scientist concedes the field of "mind" and its values" to the philosopher, and he expects the philosopher to concede to **him** in return the field of "nature."

In practice, however, there has tended to be a certain overlapping of the work of scientists and the work of philosophers in connection with the investigation of natural

phenomena. Entirely apart from the historical fact that many great scientists have been philosophers as well, and many great philosophers have been scientists as well, there have been philosophical leaders who, without command of the techniques of empirical science, and employing the logical techniques with which the dialectical elaboration of hypotheses constructed by the imagination is carried through, have ventured to compose purely speculative philosophies of nature. Schelling for some years published an "Annual of Speculative Physics," and Hegel's "Philosophy of Nature" has become a by-word among both philosophers and scientists. Of this attempt to substitute unverified and unverifiable speculation for the patient methods of science, all subsequent philosophers are thoroughly ashamed. It is conceivable that a great philosopher might occasionally hit upon a hypothesis which could have some meaning for the concrete work of scientists; but it is generally felt that unless the philosopher is also trained scientist, he should leave such work to the scientists. In the investigation of natural phenomena, there is no substitute for the empirical methods of natural science. In this sense, the gentlemen's agreement is upheld.

There is, however, a sense in which what looks like overlapping is legitimate enough. It comes from the other side. There is no encroachment by the philosophers, but there is a development by the scientists which makes a distinct contribution to philosophey, and is welcomed as such. "Critical reflection" is not the exclusive possession of philosophers, or even of workers in the field of social values. It may be, and usually is, applied by scientists to each part of the complex activities which constitute science —with results which are immediately useful to the scientist, and mediately of importance for the work of the philosopher.

In the first place, sensory observation is no simple, everyday affair. It requires a trained intelligence alert to its numerous pitfalls. Many of these are discovered willy-nilly in the work of observation, and they art partly tabulated by this or that scientist. Under the head of "errors of malobservation" or "errors of non-observation" they are systematically studied, as a sub-division of "fallacies," by logicians and thus contribute a new chapter to the "philosophy of mind."

In the second place, in manipulating, defining, concentrating, and condensing their observational researches, scientists have occasion to apply and sometimes to invent definite methods, mathematical and logical. In this way a great number of relatively isolated techniques come into existence. These too are handed over to the philosophy of mind for systematic exploration and elaboration. The theory of probability, the nature and use of statistics, and the like, (1) while investigated technically by mathematicians, are treated in their general theoretical bearings by philosophers, as chapters in the theory of scientific theory of scientific method (sometimes denominated "inductive logic"), which constitutes about one-half of most text books of logic.

In fact, if we look at the other half of such textbooks, the half known as "deductive logic," we find that its primary source is not dissimilar. The "syllogisms" associated with the name of Aristotle were developed by him in connection with the work of Greek astronomy, and the topics of "definition," "classification," "explanation," and "proof," while widely used by lawyers, debaters, and theologians, actually originated in connection with the work of Greek scientists. Thus we see that the content of logic consists almost entirely of systematizing and grounding problems bequeathed to the philosophy of mind by the concrete work of practising scientists.

There is yet another way in which the work of scientists overflows of itself into philosophy. Science is so complex that a given scientist may emphasize the value of only one side of his methods. Those who insist upon the importance of sensory observation rather easily generalize beyond their immediate researches and preach the gospel of "empiricism"—the theory that knowledge rest **entirely** upon sensation, and that mathematical and logical "necessity" is merely a refined form of factual conjunction observed to occur in a great many cases, (2). Others are convinced of the importance of mathematics and the logical manipulation of strictly defined concepts, and so preach the gospel of "rationalism" — which is so strong on consistency but it is not interested in sensory verification. (3). In this way the work of scientists gives rise to a number of "isms." These are duly taken over by the philosopher and, as systematized, grounded, and compared in respect of their

(1) "Mill's Methods," for instance, which were taken over from the Astronomer Herschel.

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Sunspots

HART FAINTUCH

WHAT are sunspots? Where do they come from? What relationship is there between sunspots and us—the inhabitants of earth?

We state as we commence our topic that much that is to be said about sunspots is known to be true—but that much is also assumption.

Scientists who have looked at the sun through telescopes, tell us that they see dark blotches on the surface of the sun. These they call sunspots. Spots such as these are the centres of violent cyclonic storms raging on the surface of the sun. These storms are so violent, that if we compare them with the most violent of cyclonic storms which we have here on earth, we would say that ours are mere puffs of wind as compared with cyclonic storms, which represent the magnitude of storms on the sun.

Hart Faintuch
Third Year Scicene has presented the greater percentage of undergraduate authors in this issue of the Question Mark, and Hart Faintuch is one of these. Hart is also a graduate of St. John's High School.

These storms on the sun are continually raging, causing as a result a continuous appearance of sunspots throughout almost every day of ever year. The number of storms, however, varies with time, and we have periods of sunspot maxima and minima. These maximum and minimum amounts of sunspots appear at nearly definite periods, namely in approximately eleven year cycles, so that if we had a minimum number of sunspots in 1933, say, we should expect a minimum in 1943-44, and a maximum in 1938-39.

Possibly one of the greatest effects that sunspots produce is that which we notice in our radio communication. We all know that at various times we have good and bad radio reception. We know that we can get good reception at night from certain far-off stations, yet we get poor reception from the same stations during the daytime. Then too, we often find that reception which was formerly good from certain far-off stations has suddenly become bad. This last is the effect which is caused by sunspots.

All the above needs a brief explanation.

Physicists at first believed that radio waves originating in the eastern hemisphere would never reach the western hemisphere. This they believed to be true since they knew that radio waves travel in straight lines. Thus, these men calculated that, due to the curvature of the earth, the radio waves would travel in a straight line from the top of the transmitting aerials as a tangent to the earth's surface. At that point of contact, radio reception from certain radio stations with that range (the length of the tangent from the aerial to the point of contact on the earth) would cease.

These physicists, however, were wrong. Professor Arthur E. Kennelly, of Harvard University and the Massachusetts Institute of Technology, advanced the idea that the earth is surrounded, at an altitude of 100 miles or more, by a region known as the ionosphere. A few months later in English scientist, Oliver Heavside, quite independent of Professor Kennelly, published a similar idea. This ionsphere acts as the radio ceiling of the earth. This ceiling consists primarily of ions created by the ultraviolet rays of the sun. Ultra violet rays, shining through the rarified atmosphere upon the molecules of oxygen and nitrogen, partly decompose the air into ions. Thus we see that the ionosphere is essentially an electrified shell. We may state here, that when radiation from the sun is more intense, ionization of the air in this region is greater. Thus, as we get more and more ions, our ionospheric shell gets thicker and thicker, with an ultimate result—the ceiling descends lower and lower towards the earth. Then too, we have the opposite effect when radiation from the sun is at a minimum. Thus we find that we have a low ceiling during the daytime—when the sun shines brightest, and a high seiling at night—when the sun is shining on the opposite side of the earth.

We stated above that the ionosphere is

the radio ceiling. An explanation of that statement is this: Radio waves emitted from the antenna of a radio station travel in all directions. Many travel along the ground. These are received by nearby radios. For the most part, however, the radio waves travel outwards and upwards, till they finally strike the ionosphere, where most of the waves are reflected, the remainder being absorbed by the shell of the ionosphere. The reflected waves then return to the earth, where they are received at various localities. We can readily see that in this way it is possible for radio waves to travel all around the earth.

Now, how do we explain good and bad reception? At this point, let us use an analogy. Suppose you are playing a game of billiards—not on an oblong table, but on a circular one. Let us suppose too that this table is endowed with the unique property of being able to change its sides. That is, this table is able to advance or retract its sides so as to make its surface smaller or larger. Now, suppose you must make a shot so that you must rebound one ball off a cushion in order to hit a stationary ball in the middle of the table. One can readily see that when the table is a certain size, you must aim at a certain point on the cushion in order to succeed in hitting the required ball, and that if the size of the table changes, the point at which you aim must change in a relative manner.

That is what happens in radio reception —with one exception: the analogy with the table only considers one plane, whereas waves travel in all planes. Waves travel differently during the day than they do at night due to the change in the height of the radio ceiling. We also know that long waves strike the radio ceiling at different places than do shorter waves if they are both emitted from the same aerial. Certain localities experience difficulty in getting the same stations quite as easily at night as they do during the day. We find that we get better reception on short wave from distant stations during the day.

Now, let us suppose that the sun suddenly experiences a cyclonic storm, causing a sudden outbreak of sunspots. This results in a sudden burst of energy in the form of ultraviolet radiation. These ultraviolet rays reach the earth, ionize the ionosphere to a greater-than-normal extent, and cause the radio ceiling to descend suddenly. Not only does this shell descend suddenly, but it also rises just as suddenly. Thus we have a ceiling that tosses about from high to low. During sunspot maxima, then, we find that this ceiling does not remain at all stationary. Then how is a certain locality to be expected to receive any one wave length throughout this storm? Engineers and physicists have often been at their wits end during just such upheavals trying to find frequencies to which they could change during these storms so that reception would not be interrupted.

Another important effect that sunspots have is that which we observe in plant growth. As previously stated, an outburst of sunspots is invariably accompanied by a subsequent outburst of ultraviolet radiation from the sun. Plants take advantage of this extra energy and use it to aid in their growth. We find then during sunspot maxima, that plants grow bigger and faster.

We all know that the age of a tree can be computed by cutting it down and counting its "rings." Professor A. E. Douglass, a most distinguished scientist of the University of Arizona, noticed, however, that all the rings of any one tree are not spaced evenly apart. That is, at times he found wide spaces between the rings, and then at times he found narrow spaces between the rings. This meant, of course, that during certain years the tree grew more rapidly than during other years—the wider spaces denoting more rapid growth. He also noted that the tree grew rapidly, then slowly in sequences of periods: a period of approximately ten to twelve years of retarded growth separating a few years of rapid growth. Noting the similarity to the sunspot cycle, Professor Dauglass began an intensive study of tree growth. By counting and examing thousands of tree rings, he was able to trace sunspot cycles 3,200 years.

Now suppose we consider ourselves. Can it be that sunspots affect our bodies? our minds? We all can recall days when we felt energetic—well, at least we all can recall days when we felt lazy. If we think hard enough, we can all find days when we were lazy—not because we were tired, and not because of the weather—but for some unknown reason. Could this reason be attributed to the effect of sunspots?

Here is something upon which we may indeed ponder: Recently it has been found that with every thought, with every act, everything we do, currents of electricity travel throughout our nervous system.

We know that the air we breathe contains ions for some unknown reason. Thus, sometimes the air we breathe is positively charged, and sometimes it is negatively

charged. The reason for this is not definitely known as yet.

Leaving the above statement for the moment, let us consider the following experiment conducted by Professor Dessauer, of Frankfort: Using an air-conditioned room in which he could control the ions, this professor subjected a number of patients alternately to positive and negative electrity. He He found that when the atmosphere in the room was changed from positive to negative, the patients experienced a subsequent change of blood pressure and mental attitude. When subjected to an abundance of positive ions, patients developed feelings of dizziness and fatigue, followed by headaches. Upon slowly removing the positive ion influence, then subjecting patients to negative ions, the fatigue and headache gave way to exhilaration, and high blood pressures were lowered.

The above experiment was also successfully carried out by Professor Yaglou of the Harvard School of Public Health. Other experimenters, however, failed to obtain satisfactory results. Therefore we cannot do anything but assume that the above mentioned phenomenon is true. If we do assume that the phenomenon is true, we are really saying that the air we breathe has an effect on our mental attitude. Let us carry our assumption one step farther. Let us assume that sunspots have the power to change not only the number and kind of sunspots in the upper atmosphere (the ionsphere), but also in the lower atmosphere, so that sometime we breathe negative ions. In any case, the problem is an interesting one, and it gives us something upon which we may ponder.

One more problem which we may discuss is the effect which sunspots may have on carrier pigeons.

It is a known fact that pigeons nearly always return to their home lofts. This fact is advantageously used in various places. Many people believe that pigeons go straight home because they memorize the direction from which they were taken. This belief is groundless. Pigeons have been known to be carried in total darkness to new lofts. Upon being freed, the pigeons flew straight home. A certain breed of pigeon will even fly at night. Then too, since birds travel home a distance 400-500 miles sometimes, it is foolish to believe that these birds memorize directions. What then is the secret of their homing instinct?

Various experiments have been carried out, the results of which showed that when pigeons were released near the antennae of broadcasting stations, the birds lost their homing instinct. Why?

It has been noticed that when a homing pigeon is released, the bird invariably rises to a great height, describes great circles in the air, then sets off directly for home.

Harlan True Stetson, Research Associate at the Massachusetts Institute of Technology, advanced this hypothesis:

He supposes that the nerve mechanism of a carrier pigeon is very much like an induction compass (1). Mr. Stetson believes that, as the bird is carried from home, its nerve fibres must cut across, the lines of force due to the earth's magnetism. This cutting through the magnetic lines of force must produce a definite "uneasiness" in the bird, and the first reaction of the pigeon upon being released is to get rid of this uneasiness.

We must suppose that when the bird gets used to its home loft, its direction with reference to the earth's magnetism is a set one. Upon being released after having been carried away from its home loft, the bird wishes to reverse the condition which has been forced upon its delicate nervous system. First the pigeon ascends. Then it describes large circles in the sky. It is supposed here that the bird does this to get the effect which we get when we turn a loop of wire in a magnetic field—create a current of electricity. This current gives the bird its direction. Then the pigeon reverses the condition forced upon it by flying home.

There are many more effects of sunspots which we could discuss, but lack of room does not permit any further discussion. Before concluding, however, we wish to state that the study of sunspots is far from complete. Possibly many of the effects of sunspots are as yet unknown. We know that sunspots are the result of cyclonic storms on the sun. We do not know, however, what causes or produces these cyclones, nor why they should come into existence periodically in maximum and minimum amounts.

So we see that the study of sunspots is an interesting one. It leaves at least one more line of research open to all students of science.

Why class distinction should not be based upon the hydrogen ion concentration value of the duodenum instead of upon the possession of positions due to monetary advantages.

Some Early Scientists

A. N. CAMPBELL.

AN unfortunate idea prevails that science is something new, that it was born about the beginning of the present century and that every day greater discoveries are made than were made the day before. The facts are, however, that the beginnings of science go back to the dawn of history, that even science as we know it may be traced back six centuries, and that the greatest discoveries in science were made, just as the greatest literary masterpieces were produced, before any of us were born. It is greatly to be regretted that the students of the average undergraduate do not include a course on the history of science.

In the absence of such a course, the method of presenting a subject inevitably smacks of the schoolroom. The material is treated as cut and dried, as if everything were a "fait accompli." Facts remain, but theories wither and fall "like Autumn leaves in the vale of Vallombrosa." The student, burning with a holy zeal, accepts as a message from Heaven So-ond-So's Theory, which is only a fashionable interpretation of the facts. The study of the history of science shows how theories have changed and will continue to change. Science is not something static but an organic growth, with its roots in the past and its fruition—where? The students of the year 2040 will say of 1940, "Oh, yes, there were some old fellows who painfully collected empirical facts, but their theories were hopelessly wrong, they had no idea of the truth." One seems to hear an echo: "We alone are the people and Wisdom will die with us."

It is to correct this painfully cock-sure attitude that the study of the history of science is so necessary. Another function of this agreeable study is that it should take us beyond the bare scientific facts of a scholar's life and give us some intimate details of the man himself: even a scientist has a personality, though this is sometimes doubted. How many generations of freshmen have become acquainted with the Law of Boyle, of whom it may be truly said "Stat nominis umbra." They forget that Boyle was a man like the rest of us, living, breathing, suffering, enjoying occasionally, with the weaknesses and idiosyncracies we all possess. These facts, however, are not unattainable; they are to be found buried in books of scientific biography

A. N. Campbell
Alan Newton Campbell, Associate Professor of Chemistry at Manitoba, obtained his B.Sc. in 1920 (London). In 1924 obtained his Ph.D., also at London. From '25—'30, was Assistant Lecturer at Aberdeen and obtained his D.Sc.

It is the purpose of what follows to indicate briefly the outstanding facts in the lives of some scientists who lived at a time when science is popularly supposed not to have existed.

We commence with Leonardo da Vinci (1452-1519), painter, sculptor(architect, and one of the greatest engineering and scientific geniuses of the Italian Renascence. While building up a reputation as a painter sufficient for a dozen of any ordinary men (he was one of the world's very greatest painters), he was also busily pursuing scientific studies and planning engineering projects, to the wonder of his Florentine contemporaries. In addition to such well-known masterpieces as "The Last Supper" and "Mona Lisa," Leonardo left a wonderful series of drawings which include sketches illustrating his engineering, mechanical and arcitectural ideas. The note books which he kept for over 40 years contain his ideas on painting which have been collected as a "Treatise on Painting," published in England in 1877; they also include notes on the mechanics of aviation, on the use of steam as motive power and innumerable other scientific ideas which, had they immediately been collected and made available, might have advanced the mechanical and scientific knowledge of mankind by centuries. But the note-books remained disregarded until 1800. Da Vinci anticipated by 200 years the experiments of Mayow, Hales and Priestley on air and he nature of combustion and respiration.

Sir Kenelm Digby (1603-1663) is known in history as a naval commander, author and diplomat, who was concerned in intrigues on behalf of the English Catholics. He was, however, a man of diverse interests. He was one of the founders of the Royal Society and his book on cookery was a highly popular "best-seller."

Among other early Fellows of the Royal Society was Elias Ashmole, the Antiquary (1617-1692). Known principally as an antiquary, Ashmole was also a lawyer and astrologer and had an interest in chemistry. He studied astronomy and mathematics at Oxford and founded the Ashmolean Museum at Oxford with antiquities mainly inherited from John Tradescant. He was a favorite with Charles II and held several Court offices. He published "Theatrum Chemicum Britannicum."

Another founder of the Royal Society was John Evelyn, the diarist (1620-1706). Evelyn was a friend of Pepys, though his diary has little in common with the more lively narrative of Pepys. He wrote many books on historical and economic subjects and on gardening, on which he was an acknowledged expert. Of these "Sylva" was the most important; it dealt with afforestation and led to great developments in that direction. Evelyn's books on trees, fruits, sallets, and gardening were also highly popular "best sellers." Though himself scarcely a scientist. Evelyn in his diary makes frequent mention of the scientists of his time and of events of scientific interest. Among the latter may be mentioned the strange case of "Beau Wilson." (Evelyn's Diary," April 22nd, 1694.)

"A very young gentleman named Wilson, the younger son of one who had not above 200 pounds a year estate, lived in the garb and equipage of the richest nobleman, for house, furniture, coaches, saddle-horses, and kept a table, and all things accordingly, redeemed his father's estate, and gave portions to his sisters, being challenged by one Laws, a Scotchman, was killed in a duel, not fairly. The mystery is how this so young a gentleman, very sober and of good fame, could live in such an expensive manner; it could not be discovered by all possible industry, or entreaty of his friends to make him reveal it. It did not appear that he was kept by women, play, coining, padding or dealing in chymistry; but he would sometimes say that if he should live ever so long, he had wherewith to maintain himself in the same manner." He was thought to be an alchemist.

This John Law, with whom the duel was fought, is another interesting character. He lived from 1671 to 1724 and might be described as an economist. He was for long resident in France, and devised several schemes of national prosperity. His schemes were explained in his "Money and Trade Considered."

Edward Boyle (1627-1691), the English physicist, was born at Lismore, Ireland. After settling at Oxford, he established a chemical laboratory and became leader of a small scientific society. He invented the air-pump and established Boyle's Law about 1660. A year later, in his work entitled "The Skeptical Chymist," he overthrew the Aristotelian idea of four "elements," and gave the modern scientific definition of an element as a substance that cannot be analysed. He was the first to conduct chemical experiments with a degree of quantitative accuracy. To his credit may be placed the modern thermometer, the use of a colour indicator to demonstrate the presence of acid, freezing mixtures, and the isolation of hydrogen and phosphorus.

Boyle was one of the founders of the Royal Society. He it was who brought Peter Sthael from abroad to teach Chemistry at Oxford, which he did from 1659 onwards. He also investigated respiration and showed, by experiments with a mouse, that air is indispensable to respiration and that only a portion of the air is active. It is recorded that Boyle made a captive mouse as comfortable as he could, by placing a piece of cheese in the receiver, which he left near the fire to keep his victim warm!

"Throughout the seventeenth century, Paris hal alchemists and chemists in plenty; but, if some professed to make gold with the help of the philosopher's stone, many made substantial gold by the preparation of poisons and their sale to magicians and sorceresses, who, for a consideration, would rid a man of his enemy or a woman of an undesirable husband or of a rival to her affections. This villainy was practised among the highest in the land. There was the celebrated case of Marie Madelaine, Marquise de Brinvilliers (1630-1676). She and her lover Sainte Croix, after experimenting on patients in hospitals, poisoned several of her relatives in order to secure their fortunes. Sainte Croix had learned something of chemistry from Christophe Glaser, who had an establishment in the Faubourg Saint Germain, was the author of a treatise on chemistry,

apothecary to the King and demonstrator at the Jardin des Plantes. Glaser, by the way, discovered sulphate of potash and manufactured "lunar caustic" (silver nitrate) in sticks. It was suggested that he furnished Sainte Croix and his mistress with poisons, but there is no definite evidence of that. Sainte Croix died while experimenting with them, but their nature was not detected. He worked in a glass mask which was found broken by his side, as he lay dead, on the floor of his laboratory. Madame de Brinvilliers was brought to trial, tortured and executed. Glaser left the country in disgrace. This was only one of the many cases, and it led to the introduction of the "Poisons Register." (1).

John Locke (1632-1704), the English philosopher and psychologist, was educated at Westminster and Christ Church, Oxford. He was interested in chemistry and meteorology as well as in philosophy, and at one time thought of becoming a physician. In 1685 he produced "Two Treatises on Government" and in 1690 the "Essay Concerning Human Understanding" which made him famous. At Oxford, Locke studied chemistry under Peter Sthael and is recorded as "troublesome in class."

Anthony a Wood (1632-1695), the English antiquary also studied chemistry under Sthael.

Another distinguished student under Sthael was Sir Christopher Wren, the great architect, who, notwithstanding his youth, was active with the "Experimental Philosophical Clubbe" at Oxford before the Restoration. When became interested, among other things in the artificial colouring of building stone and in blood transfusion. He invented a pneumatic engine, and he was President of the Royal Society from 1680 to 1682.

Wren 1632-1723) was born in E. Knoyle, Wilts.; his father was Dean of Windsor and chaplain to Charles I. At Oxford he early won fame for his brilliance as a mathematician and astronomer. He became a Fellow of All Souls in 1635, at the age of 21. Four years later he was appointed Professor of Astronomy at Gresham College, London, and later at Oxford. It was not until 1661 that he began to study architecture seriously. Wren's architecture is as remarkable for its engineering as for its beauty.

No more interesting work of its kind has been written than the "Diary" of Samuel Pepys. Chatty, scandalous and scurrilous, it presents us with an intimate record of the times of Charles II. One of the most striking facts that emerges from this account is how characters, now considered so divergent, united in one man, who might be simultaneously a court gallant, a soldier, a scholar and a philosopher (or scientist, as we should now say). Thus Scott speaks in one of his novels of the fashionables of the time, interesting themselves very keenly, in the intervals of a peculiarly lurid dissipation, in the mathematical theory of probability. Pepys' "Diary" contains continual reference to the interest in science of the same class, headed by the king himself. The "Diary" was written in cipher and was only made public after the author's death. Pepys himself was a civil servant employed at the Admiralty. He knew everyone and had many cultural interests, notably in music. Though not himself a scientist, he was at one time President of the Royal Society, and had a layman's interest in science and scientists.

Referring to his admission to the Royal Society, he says: "The discourse was on the subject of fire, and how it goes out in a place where the ayre is not free, and sooner where the ayre is exhausted, which they showed by an engine on purpose" (the air-pump). He mentions a visit to the King's little "elaboratory" and his surprise on Mr. Peter showing him the breaking of "Rupert's drops."

A typical passage in the "Dairy" runs—"So home—Sir John Minnes and I in his coach together, talking on the way of chymistry, wherein he do know something—at least, seems so to me, that cannot correct him." Minnes, author of "Musarum Deliciae," was Controller of the Navy, and ofter a source of annoyance to Pepys. He tells us that Captain Holmes called Minnes "the veriest knave and rogue and coward in the world," and, in a passage under 1662, Pepys referred to him as "pretty well fuddled."

In March, 1662, he says: In the afternoon come the German Dr. Knuffler to discourse with us about his engine to blow up ships," which apparently came to nothing; and in November, 1663, he mentions a Dr. Allen, with whom, at a coffeehouse, there was "some good discourse of physick and chemistry" and mention of "Dribble, the German doctor" having offered an instrument to sink ships." Allen told Pepys that something made of gold, which they call in chymistry "aurum fulminans" probably gold oxide—"A grain, I think, he said, of it put

(1) R. B. Pilcher: "A Century of Chemistry."

into a silver spoon and fired, will give a blow like a musquett, and strike a hole through the silver spoon downward, without the least force upward: and this he can make a cxperiment of he says, with iron prepared."

Robert Hooke (1635-1703), the English inventor, was employed by Robert Boyle in 1655, and assisted in the construction of the air-pump. Appointed curator of experiments to the Royal Society in 1662, he became in 1665 Professor of Geometry in Gresham College. After the Great Fire of London he submitted a model for the reconstruction of the City. But Wren's plan was accepted and Hooke became surveyor, a position in which he accumulated several thousand pounds, which were discovered in an iron chest after his death. All his life he was haunted by a morbid fear that someone would anticipate his discoveries.

The name of Sir Isaac Newton (1642-1727) is known to all, but the details of his life are perhaps not so well known. The great English mathematician was born at Wollsthorpe, Lincolnshire, studied at Grantham Grammar School, and later, after a period on his mother's farm, at Trinity College, Cambridge, where he was elected a scholar in 1664. A year later he discovered the elements of differential calculus, and in 1666 had his first inkling of the nature of gravitation. He turned his attention to the study of light and colour, and did important work with prisms and lenses, discovering the composition of white light. After inventing the reflecting telescope in 1668, he passed many years in research at the University, and in 1864, at the instance of Wren and Halley, returned to the problem of gravity. In a treatise "De Motu" and a larger work, the famous "Principia" (1687), he worked out in detail his old theories, and determined the attractions of masses. In 1686 Newton defended the rights of his University against the corrupt appointments of the Crown, and in 1689 represented it in Parliament. In 1694 Newton was appointed Warden of the Mint, and in 1697 he became Master. In the last years of the century he made public his system of differential calculus or "fluxions" which had also been discovered by Leibnitz in Holland. He was elected a foreign associate of the French Academy in 1699, re-entered Parliament in 1701, and became President of the Royal Society in 1703, a post he retained for nearly 25 years. Under his presidency the Royal Society made marked progress. He received a knighthood in 1705, and was later a frequent attendant at the Court of GeorgeI. In his last years he spent much time studying theology. On his death he was buried in Westminster Abbey.

Apart from his more reputable studies, Newton appears to have been something of an "Enthusiast" (a searcher for the Philosopher's Stone which was to transmute the base metals into gold. See Balzac's "La Recherche de l'Absolu" for a fascinating study of this type of individual). The chief practice of the Enthusiasts or Alchemists, as they were more generally called, seems to have consisted in the prolonged heating together of various substances in a crucible, in the hope that gold would result. Newton spent many wakeful nights tending his furnaces in this way. A more real service was rendered by Newton to chemistry when he discovered the colours of the spectrum from which the modern spectroscope has resulted.

One of the agencies which has been most potent in furthering the study of science is the Royal Society. This is the chief scientific society in Britain, originating in the meeting in London in 1645 of a number of learned men for the purpose of discussing scientific problems. Some of the members removed to Oxford in 1648 and held meetings at Wadha mCollege. Within ten years they returned to London and resumed meetings this time at Gresham College. In 1660 a society was former. which was incorporated by Charles II in 1662. In 1710 the venue of meetings was changed from Gresham College to Crane Court, Fleet Street, and in 1780 to Somerset House. Since 1857 the the Society had had rooms at Burlington House, Piccadilly. Membership is restricted to persons who have contributed to the advancement of science either by research or by financing research, and new Fellows to the number of 15 are elected annually, not more than two, as a rule, being chosen from any one branch of science.

Among the founders of the Royal Society were the Honourable Robert Boyle, Prince Rupert, The Duke of Buckingham, Lord Brouncker, Sir Kenelm Digby, John Wilkins, Bishop of Chester, Dr. Thomas Willis. William Petty, Ralph Bathurst, Dean of Wells, Dr. Walter Charleton and John Evelyn, the diarist. Other early Fellows of the Royal Society were John Aubrey, the naturalist and antiquary, Abram Cowley, the poet, Elias Ashmole, the antiquary, and Dr. Jonathan Goddard, of whom Aubrey says:

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Blood Tranfusion and the War

By JACK WINCHESTER AND TOM OLENICK

NO elucidations of any kind whatever are either asked for or expected when the statement, "This is a scientific war," is heard. Oddly enough, the people of past generations also believed that their particular war was the most scientific. This was believed not only because more modern methods of slaughtering people were being devised, but also because, and in the writer's estimation this is of greater import, in times of war some of the most brilliant chemists, physicists, and medical research workers turn their full attention toward the war industry. There is no doubt that during a period of concentrate research such as this some of the greatest advances in the Industrial, Commercial, and Medical fields are made. Let us now consider, in the last-mentioned field, the process of Blood Transfusion, its necessity, something of its history, and the methods by means of which it is carried out, particularly under war conditions.

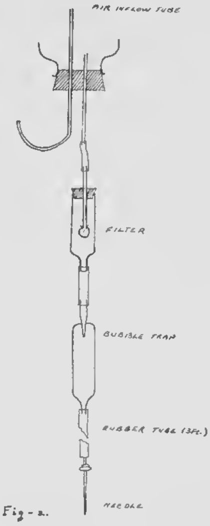

Fig - 2.

Blood is a tissue. To come this may appear to be a humorous statement, but nevertheless, it is a moving tissue, another vital factor in the body, for without it life cannot continue. The function of blood is to supply all cells of the body with oxygen, to carry away their waste products, and to supply them with digested food. If sufficient food and oxygen are not supplied to the cells and the waste products not taken away, the cells soon die, thus causing the death of the patient. Therefore, one may readily understand the necessity of an adequate supply of blood in the body at all times.

The principal conditions necessitating a blood transfusion are those produced in shock, hemorrhage, and burns. Even to one not acquainted with the battle-front, no stretching of the imagination is necessary in order to realize the number of casualties requiring a transfusion. In shock, the muscles of the blood vessels relax, and the vessels themselves dilate greatly, resulting in a great increase in the total volume of the circulatory system. This increase in the volume of the blood causes the blood pressure to fall. If the blood pressure falls below the level essential to the welfare of the tissues, death will result, unless the volume of blood is quickly increased. In severe hemorrhage, on the other hand, blood is lost in large quantities, so that often not only one transfusion, but several have to be made before any signs of life are observed in the patient. Burns, another frequent occurrence on the modern battle-front, are also treated by blood transfusion in cases where the patient has lost much fluid, or is in a state of shock. As hemorrhage, shock and burns also occur among civilians, it may be seen that blood transfusion has a very necessary place in our civic hospitals as well as at the front.

Before the methods of blood transfusions are discussed it would be interesting to review the evolution of the science of blood transfusion. The present highly efficient methods have been elaborated as the result of the efforts of hundreds of workers during the past four centuries. Some of these pioneer investigators spent their entire fortunes and lives in their efforts to find efficient methods of transferring life-giving blood from the strong and healthy to those whose lives were endangered by the lack of it. Yes, the history of Blood Transfusion is indeed both an interesting and fascinating study.

As far back as 1492 the use of blood as a therapeutic measure was advocated. We can now note with amusement that in the above mentioned year a transfusion was given to the aged Pope Innocent VIII, at the expense of three youths, in order to rejuvenate him. Why the blood was first believed to be of

great benefit for rejuvenation is not known, but according to Libavius (1614), there had to be "a young man, robust, full of spirituous blood, and also an old man, thin, emaciated, his strength exhausted, hardly able to retain his soul. Let the performer of the operation have two silver tubes fitting into one another. Let him open the artery of the young man put it into one of the tubes, fastening it in; let him immediately after open the artery of the old man, and put the female tube into it, and then the two tubes being joined, the hot and spitituous blood of the young man will pour into the old one as it were from a fountain of life, and all of his weakness will be dispelled." It is intercsting to note that the method of transfusion described by him was used until quite recently.

Harvey, the discoverer of the circulation of blood, was the institgator of further research along these lines. From approximately the years 1620 to 1680 such men as Christopher Wren (1658), Robert Boyle, Richard Lower, Denys, and Emmerez carried on the work, some of them with disastrous results to themselves and to their patients. For this period it will be sufficient to say that from Wren's experiments on dogs, the technique of blood transfusions reaches the stage where it could be used on humans. Denys, in 1667, performed the first recorded transfusion on a patient by transferring nine ounces of blood from the carotid artery of a lamb into the veins of a man. When his patient died, the French court made it illegal to perform any such experiments or operations without the consent of the Faculty of Medicine.

The next period during which further advances were made begins in 1818, when James Blundell devised a new apparatus for the transfusion of blood. The cause of his desire for the renewal of experimentation—a field almost forgotten for over one hundred and fifty years—was the death of many of his patients from hemorrhage during childbirth. This so renewed interest in blood transfusion that the modern workers, that is, those working from 1900 to the present day, had new problems to face. Their predecessors were concerned with the actual process of transferring blood from donor to recipient, while they themselves are concerned with the perfection of the transfusion apparatus and technique. The first problem that had to be overcome was the unfavorable reactions caused by "incompatibility" of the bloods of donor and recipient. For example, if the blood of the example, if the blood of the donor is incompatible with that of the recipient, clotting occurs and may result in the death of the patient. It is worth while to note that prior to 1900 animal blood was transfused to humans, the results ranging from death to hemoglobinuria (black urine). Due to the work done by Ponfick and Landois towards the end of the 19th century the transfusion of animal blood was discarded, for they showed that only transfusions between animals of the same species were safe. The work from this point was carried on by Landsteiner who solved the first problem in 1900. He showed that " the serum of one normal human being can agglutinate or hemolyze the bloods of certain other individuals." Landsteiner carried on with this work, and in 1901 published his paper on blood groups and their importance in blood transfusion. Many other workers continued in this field, the final result being the division of human blood into four types, AB, A. B. and O. It was found that: the AB type is the universal recipient, (i.e., coulds receive transfusion from any other type); A is agglutinated by O and B, and hence cannot be given to O or B; B is agglutinated by O and A, and therefore cannot be given to O or A; and O is not agglutinated by any other type and hence is referred to as the universal donor. Extensive use of this information was made during the first World War, and its usefulness firmly established as a vital factor in blood transfusion.

Thomas Z. Olenick
Tom is well known to the students as the Editor-in-Chief of the U.M.S.U. Telephone Directory. He is also the Publicity Manager for the Brown and Gold year book. Tom is now in Third Year Science. "Blood Transfusion" is a well chosen topic for this co-author, since he intends to study Medicine.

The next problem to be tackled was that of coagulation of the blood on contact with the atmosphere during transfusion. This was overcome firstly, by devising new ap-

paratus, and secondly, by the use of anti-coagulant chemicals, such as Sodium Citrate.

Three general methods of transfusing blood are in use today: (1) the direct method, (2) the semi-direct method, and (3) the indirect method. The direct method was the first one used and it entailed connecting the artery of the donor to the vein of the recipient, by means of a small cannula. This method has been abandoned — for several reasons, the most important being that considerable surgical skill was necessary in connecting the artery and vein, that there was no means of accurately measuring the amount of tranfused blood, and lastly that there was the possibility of transfering disease from the recipient to the donor.

Jack Winchester
Jack is also a Third Year Science student. He is on the staff of the Question Mark in the capacity of Assistant Editor. Jack has compiled an interesting article together with his co-author, Tom Olenick, on the subject of blood transfusion.

The semi-direct method is the one at present widely used in hospitals which do not have a very large number of transfusions to carry out. The apparatus consists of a number of syringes which are kept constantly clean by washing with saline solution. While one operator injects one syringe-full of blood into the recipient, the other operator is drawing a second syringe-full of blood from the donor. Each syringe is washed out with saline solution before and after injection. The process is continued until sufficient blood has been transfused. In this way the amount of blood transfused can be measured, but the problem of coagulation is not overcome. This syringe method may be modified, a special syringe with a four-way stop-cock being used. The semi-direct method is the one commonly used in Winnipeg today. The indirect method involves the drawing of blood from the donor into a special receptacle from which it is administered to the recipient. either immediately, or after a period of storage.

The first two methods mentioned above are, of course, of little use in war, except perhaps in civilian hospitals. At the front, particularly in a war as mobile as the present one, it is impossible to have a supply of donors always on hand. It may be suggested that the soldiers themselves may be called upon to give blood in order to save the lives of their less fortunate comrades. In fact, the Germans are said to have used this idea during the Polish invasion. They are said to have typed the blood of every soldier, and to have so arranged their platoons that all the men in any one platoon were of the same blood type. However, it is felt that the fighting efficiency of the men would be decreased if they were continually having to lose 300 or 400 c.c. of blood, for even the hardiest soldier must be in top-notch condition in order to withstand the hardships of life in the firing-line. So that actually the third method of transfusion, which permits of storing the blood, is the only one which can be used extensively at the front.

The first difficulty to be overcome in the storing of blood is that of coagulation, or clotting. If blood is simply drawn from the donor into bottles, it very quickly becomes a hardened mass, similar to the scab formed over any ordinary cut. In order to overcome this, the blood must be "citrated" immediately after it is taken from the donor. Citration is simply the introduction of a 3.8% of Sodium Citrate, which prevents the blood from clotting, and has no harmful effect upon the recipient.

When blood is to be taken from a donor for storage, the requisite amount of citrate is placed in a 20-oz. bottle, which is fitted with a double cap. The outside portion of the cap is of aluminum, and is pierced with two fine holes. The inner portion is of rubber. A rubber tube is fitted with a needle at each end, and is sterilized along with the bottle. One needle is placed into the donor's vein, the other through one of the holes in the aluminum cap and through its rubber lining, producing an air-tight joint. As the bottle was sealed while still hot from the sterilizer, a partial vacuum was created within it. This vacuum starts the flow of blood, which continues to flow by gravity. A second hole in the aluminum cap above it. When the bottle is full it is sealed over and stored at 2° to 4° C.

For administration of the stored blood, the appartus shown in fig a is used. The storage bottle is fitted with a rubber stopper

through which run two tubes—one long on which allows air to enter the bottle, but carries it right to the bottom; and one shorter one connected through a filter and bubble trap to a three-foot rubber tube, the end of which is fitted with a needle. The filter may be of the gas-mantle type, as shown, or may consist of a column of glass beads. The bubble trap is sometimes dispensed with. The whole apparatus is sterilized and the blood brought to body temperature by immersing the bottle in water not hotter than 104° F. The aluminum and rubber cap is replaced by the rubber stopper, the bottle is inverted and suspended at a convenient height, and transfusion is begun.

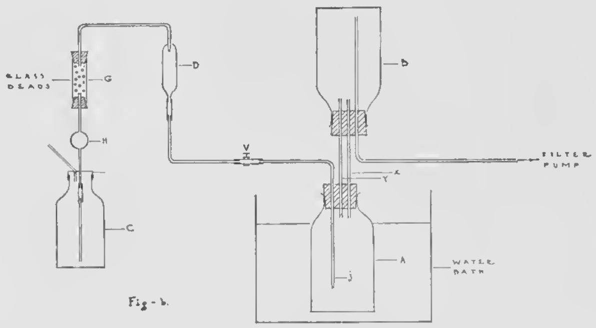

Fig. b.

Death due to hemorrhage was long believed to be caused by the loss of red cells, but this is found not to be the case. Brodin and Saint Girons, state in La Gazette de la Societe Medicale Des Hospitaux de Paris of Nov. 10, 1939: "La mort est fatale lorsque la masse canguine tombe au-dessous de 25p. 100". These two workers showed this by bleeding a dog gradually and successively re-injecting its own plasma, after removing all the red cells. They state that the dog will not die, even though almost all its red cells have been removed. Thus it becomes evident that the desired effect in transfusion is obtained principally from the plasma, the erythrocytes playing a secondary part.

Whole blood deteriorates when stored, even under the best of conditions, and is useful for a period of only about twenty-eight days, or less. However, if the erythrocytes be removed, the remaining plasma may be stored for an indefinite period, as long as it is kept free from bacterial action. So probably the best method of effecting transfusions in the firing line is by having a supply of sterile human plasma on hand. The only difficulty here is in obtaining a sufficient supply of blood for making the plasma. In 1918 Brodin et Saint-Girons injected 500 c.c. of horse plasma into several different patients without any difficulty. If a shortage of human plasma should occur, this might well become an important source in wartime.

The plasma as a whole seems to have its value in increasing the total amount of fluid in the blood vessels, but apparently the plasma proteins also play a very important role in wound shock and in hemorrhage. Normal plasma contains 6.5 to 8.5 grams of protein per hundred c.c., the most important proteins being fibrinogen, serum globulin, and serum albumin. These are extremely complex proteins of very high molecular weight. The molecular of fibrinogen is the highest of the three, and has not yet been calculated. Serum globulin has a molecular weight of 100,00, serum albumin 40,000. Fibrinogen functions in the clotting of blood, the function of the other two apparently being entirely to maintain the osmotic pressure of the blood so that adequate interchange may be made between blood plasma and the tissue fluids during capillary circulation. Now in cases of wound shock, a condition is produced in which too much fluid is allowed to exude from the capillaries to the tissues, resulting in diminished blood volume and haemaconcentration. In such cases plasma is the ideal fluid, because it produces the necessary rise in osmotic pressure without increasing the number of erythrocytes. And even in cases of acute hemorrhage, as previously explained, it is almost impossible for the patient to lose a dangerously large amount of red cells. Also, as pointed out above, plasma may be stored indefinitely. Plasma has in addition the decided advantage of not having to be typed before transfusion, as little trouble with agglutination is experienced in its administration. AB plasma is ideal, because it contains no agglutinin, but artifical AB plasma may be produced by mixing equal quantities of A and B blood. The A cells take out the agglutinin from the B blood and vice versa, leaving a plasma without any agglutinins. This makes possible the acceptance as donors of many people, who previously had to be refused because

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Science's Foe--The Anti-Vivisectionist

By MANUEL SHAW

EVER since science made its first bold appearance into the world of man, it has been hindered and periodically crushed by the curtain of ignorance "that human flesh is heir to."

Galileo, the founder of the doctrine of dynamics, was persecuted for his insolence in disagreeing with the Church's version, that the earth was the centre of the universe. Leeuwenhoek, the father of microscopy, was ignored by that enlightened group, the Royal Society. Pasteur, the founder of the germ theory of disease, was ridiculed by the greatest medical authorities of his day. Lavoisier was guillotined because the French Republic had no need of learned men. Many other cases can be cited, but they will all go to prove the fact, that for every step in the direction of scientific and human progress, the clumsy weight of ignorance had first to be overthrown. Galileo was certainly correct when he said, "I believe that there is no greater hatred in the whole world, than that of ignorance for knowledge." He might have added "and truth."

Nor are we free from this pestilence in the life-blood of science today. The modern scientific atmosphere is polluted with the cackling utterings of the anti-vivisectionists, those dear kind souls who think it their moral christian duty to protest and halt the practice of submitting animals to the effects of experimentation in the medical research laboratories.

Societies of these anti-vivisectionists have been set up by righteous women who are indignant at the thought of poor, harmless, animals, forced to surrender their lives to prying scientific men. A human animal begging on the streets for a crust of bread is ignored by these women who are shocked at the thought of some monkey receiving an injection of a deadly virus. These noble crusaders are determined to protect dumb animals against the vicious onslaught of irresponsible medical investigators. Some of the more mentally-advanced anti-vivisectionists who realize the importance of medical research, argue that regardless of the benefits received from vivisection, animals, nevertheless, must not be subjected to such inhumane treatment. Other methods, they say, should be employed, such as the close scrutiny of clinical patients or post-mortem examination. If this were resorted to, the accomplishments of the last fifty years of medical research might only be realized in a few thousand years. One fact remains, however, that if the anti-vivisectionists had their say,there would be ample opportunity for post-mortem examination.

One cannot understand why, in a relatively enlightened world, certain people expend so much of their energy in the support of ignorant causes when this same energy could be used in more worthwhile endeavours. Sums of money are spent yearly by anti-vivisectionist societies for the distribution of nonsensical propaganda, when this same money could be used to alleviated the sufferings of human animals who are martyrs to economic experimentation.

Let us compare the work that has been done so far by vivisectionists and their humane opponents, the anti-vivisectionists. Since it would take volumes to review the accomplishments of the vivisectionists, we can only take a general view of their work. Pasteur, by his working with dogs, found an antidote to rabies. Banting, experimenting upon this same type of animal, gave insulin to the world, and if there are any diabetic anti-vivisectionists in existence, they are either hypocrites or simply ignorant. Ehrlich with his salvarsan, gave us a means of combatting syphilis, and whether or not, the anti-vivisectionists consider this a hush-hush topic, the great prevalence of this disease still remains a disturbing reality. Can these ignorant animal-protectors fail to realize the fact that thousands of children have been protected against dipitheria and smallpox? That they themselves can look forward to a healthier and happier life that was impossible in the days before medical research? And now what have they done in their anti-vivisection program? They have held meetings where they hotly demanded that animals be protected from researchers. They have believed it their sole duty in life to act as saviours to creatures of a lower level than themselves. They have prepared pamphlets for distribution urging the cooperation of other humane people like themselves, and then would return home in time to give baby his pasteurized milk.

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Some Early Scientists

(*Continued from page 22*)

"when any curious experiment was to be borne, they would lay the task to him."

King Charles gave a Charter to the Royal Society and was always curious about their experiments. Pepys says "he (the King) mightily laughed at them, for spending time only in weighing of ayre and doing nothing else since they sat." He put questions to them and became impatient when they could not readily answer them. For a whole month they were perplexed with his enquiry —why a bucket of water, into which a fish had been thrown, weighed no more with the fish than without it? Of course, it weighed more. It seems strange that no one thought of performing the experiment.

Today science has no greater honour to confer than F.R.S., but in the reign of Queen Anne, the Society was a laughing-stock, and men called "Virtuosi" pottered about "looking, and doubtless thinking, that they were mighty wise." Samuel Butler, author of "Hudibras," which King Charles loved to quote, had made fun of it, and Steele must needs give a little dig at it:

"When I meet with a young fellow, that is an humble admirer of these sciences, but more dull than the rest of the company, I conclude him to be a Fellow of the Royal Society." Addison, too, could not resist the temptation of girding at it. In a letter from the Widow Gimcrack ("Tatler," No. 221) he says, "When I married this Gentleman he had a very handsome estate, but upon buying a set of Microscopes he was chosen a Fellow of the Royal Society, from which time I do not remember ever to have heard him speak as other people did, or talk in a manner that any of his family could understand."

Gottfried Wilhelm von Leibnitz (1646-1716) the celebrated German mathematician, graduated Doctor of Laws at Altdorf, and pursued chemical investigations at Nurnberg. He later became a professor at Wurtemberg and served the Elector of Mainz. He advanced bold theories in his "Theory of Concrete Motion and "Theory of Abstract Motion," and became one of the leading philosophers of all time. In 1672 at Paris he met Malebranche and Huygens, and next year travelled to London, where he became acquainted with Newton, Boyle and others, and was chosen a Fellow of the Royal Society. In 1676 he became Councillor and Librarian to the Duke of Brunswick-Luneberg in Hanover, and made his mathematical discovery of the infinitesimal calculus which led to much controversy. He was the founder and first President of the Berlin Academy and Secretary of the Rosicrucians.

All the world knows that the "Gulliver's Travels" of Dean Swift (1667-1745) is a biting satire on human nature in general, but it is not so generally recognized that "the third part of 'Gulliver's Travels'" is in general written against chymists, mathematicians, mechanics, and projectors of all kinds" (Lord Orrey). In proof of this may be cited such passages as: "He has been eight years upon a project for extracting sunbeams from cucumbers" and " . . . he gave it for his opinion, that whoever could make two ears of corn, or two blades of grass, to grow upon a spot of ground where only one grew before, would deserve better of mankind, and do more essential service to his country, than the whole race of politicians put together." The latter quotation has ceased to be satire, since the labours of scientifice agriculture have accomplished it.

"René Antoine Ferchault, Seigneur de Réaumur (1682-1757) studied mathematics and physics at Bourges, until 1703, when he went to Paris where he was admitted a member of the Academy in 1708. His first few published papers were mathematical but he later turned to natural history, studying the formation of shells and the habits of snails and spiders. Bohn had suggested that spiders could spin silk that might be useful for textiles, the Reaumur sought to ascertain whether these insects might be reared for profit, but he found that they could not be kept together without behaving like cannibals, destroying and eating one another, the ladies being the chief culprits.

He investigated the means by which various sea creatures attach themselves to solid bodies and again disengage themselves. In the course of this enquiry, he discovered quantities of mussels of a kind which yielded a purple dye. The rocks and sandy ridges were covered with small oval grains, some white, others yellowish, and having squeezed some of these on the sleeve of his shirt, he found, in half an hour, that the wetted spots had become dyed purple, and that the colour resisted washing. Subsequently he discovered that both light and air were necessary to render the dyeing efficacious. (This dye, or something very like it, was, however, known to the ancients, under the name of Tyrian purple; the Emperors' robes were dyed with it and

its use was restricted to the royal family. Its colour was greatly admired, but compared with our modern aniline dyes it must have been a poor thing.)

Reaumur also proved that young crabs and lobsters when they lost their claws, grew new ones which replaced those they had lost. He experimented with turquoises and pearls; he knew the constitution of the pearl (calcium carbonate) and that its culture could be effected artificially by the introduction of a grain of sand within the shell of the living mollusc. It was left to a distingushed Japanese nobleman, Mikimoto, nearly two centuries later, to make a great fortune by this discovery.

In 1722, when Reaumur initiated the manufacture of steel in France, the Duc d'Orleans, then Regent, proposed that he should be rewarded by a pension of 12,000 livres. Reaumur asked that it should be given in the name of the Academy, and should be devoted, after his death, to the encouragement of the Arts—which request was duly granted by Letters Patent.

Steel and tin-plate had been imported from Germany. English tin-plate, however, was preferred to the German, because in Germany the iron was hammered, while in England it was rolled and the plates were smoother. Reaumur solved the problem of tinning iron, and introduced the industory into his country. He also investigated Chinese porcelain and made a curious experiment with glass. Taking a glass vessel he secured it in sand, heated it to redness, and then allowed it to cool very slowly, when it had become more refractory than glass, and had the appearance of stoneware. It was known as Reaumur's porcelain. His name is perhaps best remembered by his thermometer, which he graduated by taking the freezing point of water as zero and the boiling point of water at 80°. Although used in France and elsewhere for many years it was not accurate for the higher range of temperatures, because Reaumur used spirit of wine, which at its boiling point became partly vaporized in the space above the liquid. Later, Deluc substituted mercury for spirit, but Fahrenheit had adopted mercury as early as 1709." (2).

When speaking of thermometers, the name of Fahrenheit naturally occurs. Gabriel Daniel Fahrenheit (1686-1736), the German scientist, became a resident of Amsterdam and there invented the thermometer which bears his name. He was the first to use mercury as an expanding medium in temperature-measuring instruments, and had his scale been more scientifically devised, his instrument would probably never have been surpassed. Setting his zero at the lowest point to which the mercury sank in the winter of 1709, he produced an unpractical scale with freezing-point of 32° and boiling point 212°, which is still in use in the English speaking world, except for scientific purposes.

We close with an account of that most remarkable character Emanuel, Baron von Swedenborg (1688-1772). This Swedish scientist and mystic, the son of a Swedish Lutheran Bishop — Svedborg — was born at Stockholm, and educated at the University of Upsala, where he studied classical languages, natural philosophy, and mathematics. As a young man he travelled much, and neglected no opportunity of gaining knowledge of crafts and industries. Always seeking to get back to first principles, he was anxious to be able to account for everything.

In 1710 he pursued his studies in Holland, France, Germany and England, passing some time at Oxford. Swedenborg paid particular attention to chemical industries, vitriols, arsenic and sulphur works, copper and tin smelting, paper manufacture and mining — and studied all branches of science. He became interested in metallurgy his work in this field being commended a century later by Dr. Percy. He studied mining all over Europe, worked out a mechanical theory of the universe, wrote several advanced works on metallurgy and palaeontology and discovered the nebular theory of the formation of planets. During this time he accumulated a vast wealth of scientific knowledge, which he extended by an intensive study of anatomy from 1734 to 1745. He contrived a submarine vessel, also a flying machine, but the latter was not considered feasible by the great engineer Polhammar, who said that it was as difficult as perpetual motion or transmutation. Polhammar, however, thought very highly of Swedenborg, who would have become his son-in-law had his daughter been willing; but the lady, who was much younger, would not have him.

On his return to Sweden, Swedenborg was appointed assessor-extraordinary to the Swedish board of mines by Charles XII, with whom he was in constant touch on scientific questions. He published several treatises on chemistry, physics, and other scientific subjects. His "Introduction to the Philosophy of the Infinite and the Final

(2) R. B. Pilcher: "A Century of Chemistry."

Cause of Creation" (1734) gave him an international reputation. At the same time he made discoveries concerning the relation between respiration and brain-functioning, the functions of the spinal cord and ductless glands, which have only recently been corraborated. During all this experiment and research in avowed object was to "approach the soul by the analytical way", and from 1745 he devoted himself wholly to spiritual matters. Swedenborg died in London, having gained numerous followers there, who in 1788 formed an organized society, known as the New Jerusalem Church. A Swedenborg Society also exists in London for the publication and propagation of his works in all languages.

We have covered a period of some threc hundred years, finishing about the year 1772, at which time it is popularly supposed that science had not yet begun. During this period some of the most important discoveries of science were made and some of the most remarkable men had their being. The material of this sketch has been drawn from encyclopaedias and, in particular, from R. B. Pilcher's "A Century of Chemistry; from Boyle to Priestley." The sole purpose is to draw the student's attention to a fascinating and neglected branch of study.

Gas Warfare

(Continued from page 5)

What then are the possibilities of the enemy introducing something more deadly than the known battle gas? Contrary to the general belief the number of substances is limited, since only small molecules are capable of existing as a gas or vapour. Again, for over 100 years chemists have been engaged in investigating possible combinations of atoms and the properties of the substances thus produced, so that the chance of an unsuspected small-molecule compound being discovered, is remote. In the case of particulate clouds, or smokes, the range is rather wider, and, of course, the charcoal in the respirator, adequate to absorb all true gases, except the very small molecules of carbon monoxide, fails to give protection against smokes. However, the filter which is now an integral part of all respirators, arrests these tiny solid particles quite efficiently. Against soldiers and civilians equipped with these respirators then, there is little chance of a surprise affect being produced by an inhalant poison, unless it combines the properties of being odourless, colourless, and non-irritating, and can therefore attain toxic concentration before its presence is suspected. And these are not the only factors; ease of manufacture, availability of raw materials, and stability both in storage and during propulsion, are a few of the other considerations which limit the choice. The big discovery of the last war was the group known as the blister gases, substances whose action on the body was universal and not confined to inhalation, but in that group it is unlikely that anything more effective than mustard gas or lewisite will be evolved.

In conclusion, the menace of gas warfare is still a real one, and we would be foolish indeed if we relaxed any of our precautions. The Germans have always pinned their hopes on surprise tactics, and it would be infinitely better to have no gas attacks because of our preparedness, than to be caught unawares as we were once before.

Science and Philosophy

(Continued from page 15)

functions and limitations, furnish almost the entire content of that division of the philosophy of mind which is known as "epistemology" or theory of knowledge.

Finally, even scientists are human and thus are occasionally subject to the error of constructing and applying—usually outside their own fields—hypotheses which are imperfectly verified. An eminent physicist advising in matters of economics or of social philosophy, or an eminent astronomer advising on matters of metaphysics and philosophy of religion, may conceivably interest the philosopher as well as the man in the street. But the training in exact thinking in a restricted field (upon which the scientist's success so often depends) unfits a man for effective thinking in a field in which broad experience and long training in the pitfalls of general speculation seem essential; and the extra-scientific pronouncements of men of science are usually met with the critical reflection that one philosophic lesson remains to be learnt, namely, the lesson of self-criticism which restricts a man's efforts—whether scientist or philo-

(2) The founders of this view were the medical scientists Celsus and Galen, and in modern times, the medical F.R.S., John Locke.

(3) The chief founders of this view were the mathematicians Descartes and Leibniz. In our own day the mathematical physicist Einstein is usually classed with the rationalists.

sopher—to the field in which he is genuinely competent.

Thus the scientist contributes to the philosophy of mind many of its data and many, perhaps most, of its problems; while the philosopher contributes to science a sound logic and theory of knowledge. Each carefully remains on his side of the fence and neither successfully encroaches upon the territory of the other.

One final question—is the frontier-line between science and philosophy, fixed, or is it subject to periodic revision? History shows that in proportion as large bodies of data accumulate and lie open to observation and quantitatively exact manipulations, they tend to pass over into the territory of science; (4) leaving to philosophy only such parts of the field of experience as can, for the time being, be handled only by general reasoning. Thus in our day the "social sciences" of psychology, economics, sociology, and education occupy a sort of no man's land. They have passed beyond the control of philosophy, but are not yet entirely adopted by the thoroughly established natural sciences. The adoption will, however (it is expected), come soon; and it is universally supposed that science will continue to advance its frontiers, while philosophy will continue to retreat: co-operating usefully to the end and welcoming always the greater precision, certitude, and control which the methods of science confer upon each field to which they are successfully applied.

(4) Thus logic is itself frequently regarded as a science—on a par with mathematics.

Science and Politics

(Continued from page 11)

It must be remembered that the pursuit of a profession is no one's right; it is a privilege. From the time of the witch-doctor each society has regulated the practice of the are of healing in ways somewhat adapted to its needs and knowledge. Up to the present, training and licensing has been confined to a limited few, and this, at the instigation of the profession, has been made a matter of legal control. The public's view is that this exclusive privilege carries with it obligations. The State's view is that, having set up the original conditions of practice, it may vary them for the future. And there seems to be no logical way of avoiding this conclusion. By invoking State aid to exclude the quack and the ill-trained from the practice of medicine, the medical practitioner necessarily acquiesced in State determination of who may practice, where he may practice, and the classes of patients, etc. At the same time, however, the arrangement was in the nature of an agreement. The State gave legal monopoly to the profession, and the latter, through its official organization, undertook that its members would be duly trained and certified by appropriate scientific schools. The expectation was that this would provide adequate medical attention both qualitatively and quantitatively. Now, today, the State calls for a revision of the agreement, on the ground that, quantitatively, enough medical attention is not being secured.

The danger to the medical profession is very great. If it does not accept some change there is good reason for believing that other competitors in pretended healing arts will be admitted by the State. On the other hand, the prestige of the profession is still so high here that it can make an advantageous new agreement. This was, incidentally, the case in Great Britain; but it may not be the case in many American States, where the reluctance of the profession to compromise with the State has brought licensed herbalists, chiropractors, osteopaths, faith-healers, psycho-analysts, etc., into the picture. It is not for me to discuss here the question of policy involved in the advisability of continuing these other competitors in the field of public health. That would resolve itself into an inquiry into the extent to which any one of them were really engaged in applying a scientific body of knowledge to the healing arts. But this much is beyond question that the State has regulated medicine in the past and is getting ready to amend its regulation for the future. It has done so elsewhere and may do so here very shortly.

But it must not be thought that because the State makes a pretence at being omnicompetent it really is all-wise, and all-powerful. Governments only move because they are spurred by individuals and groups of individuals. The State can only act through agents. If it be true that we are passing from individualism to increasing collectivism, it is also true that the State has to adapt itself to its new functions by acquiring new machinery. When speaking earlier of "pure" science, I said that it was not necessarily the case that State education and support meant control of research. Now here, too, it must be said that State Medicine does not necessarily imply complete direction

by the State. The State cannot itself enter this field without the aid of the "applied" scientist. The profession can offer its terms. It is possible for the medical profession to propose the conditions under which the practitioner will undertake socialized medical work, to insist on the patient's right to choose his family physician, and perhaps to demand that all panel doctors have time left for some private practice. Study of systems used abroad will reveal that State Medicine does not necessarily mean enslavement by the great Leviathan, the State. That there will have to be changes in standards of motivation is also clear. But it is a poor and indifferent profession which cannot adapt itself and still make its interests felt in a world so conscious of the merits and benefits of this vocation.

You Science Students

(Continued from page 3)

results may not be coming out as they would wish, and find out what is going on in your university. If you wish to do a little extra work in the laboratory, I do not think you will meet with serious discouragement, nor will it be impossible to find the time. Remember that you learn by doing far better than by reading or listening to talk.

Never as at the present time, has it been so absolutely vital that you should make the fullest use of the opportunities that the University provides for the gaining of scientific knowledge. Science at the moment is, above everything, the weapon with which we shall certainly defeat our enemies. In the future it will be equally important, though not so exclusively so. A large part of the task of reconstruction and of assuring that victory brings its full reward will depend upon science for its accomplishment. It is you, the coming scientific thinkers, teachers and research workers who will largely depend upon how well you are now using your time. Never have university students been of such consequence to the British Commonwealth and to mankind in general as you are today.

I will mention one more fact. We have often in the past felt that our university has suffered disadvantages because of its remoteness from other universities, particularly in regard to its distance from the richer and better equipped colleges of Great Britain. Now, what was once a drawback is a very definite advantage. The universities in England and Scotland are in the front line of the Battle of Britain. Some of those in the more dangerous areas have found it necessary to practically close down while their students have been distributed amongst others less unfavourably situated. They are carrying on but are doing so under very grave difficulties. You here, on the other hand, are able to work without interference. After the present war there may thus be a serious shortage of well-trained first rank scientists and, well, it is up to you.

Science's Foe

(Continued from page 27)

In Dr. W. W. Keen's pamphlet concerning anti-vivisection, he refers to Dr. Flexner's experiments on cerebrospinal meningitis, a most deadly disease: "which was the more cruel, Dr. Flexner and his assistants who operated on 25 monkeys and 100 guinea-pigs with the pure and holy purpose of finding an antidote to a deadly disease and with the result of saving hundreds, and in future thousands on thousands of human lives; or the women who were 'fanned into fury' in their opposition to all experiments on living animals at the Rockefeller Institute 'no matter how great the anticipated benefit' ".

"If these misguided women had had their way, they would have nailed up the doors of the Rockefeller Institute, would have prevented these experiments on one hundred and twenty-five animals, and by doing so would have ruthlessly condemned to death for all future time five hundred human beings in every one thousand attacked by cerebrospinal meningitis!"

How many of these sincere anti-vivisectionists would rather see their children choke to death from diphitheria, than to give them immunity with an inoculation? How many of them would gamble in the belief they weren't syphilitic than to submit to a Wasserman test? How many of them would refuse to take unsulin if attacked by diabetes? If any individual anti-vivisectionist was in such a predicament, it is certain that this staunch fighter would forget her animal friends. She would indeed be thankful for the existence of such laboratory animals as the guinea-pig, the rat, and the dog. She would praise, not condemn, the vigilant research worker, who tirelessly gives all his effort in the alleviation of human suffering.

Neurotic Animals

(*Continued from page 8*)

other times it was punished by an electric shock. It was found under these conditions that the rats had to contend with two conflicting stresses. On the one hand, they had to hold back the flexion of the right foreleg until a bright light appeared; on the other, they were required to discriminate, on pain of shock, between two bright lights before making the flexion. A correct choice was rewarded with food. This experimental set-up required the rats simultaneously to make a response and to inhibit that same response, depending upon the rats' correct discrimination. The conflict arising out of this situation was too much for three of the rats, who became neurotic and showed the typical neurotic behavior of animals, namely, restlessness, irritability, increased respiration and pulse, and periods of immobility and stupor.

Maier used the Lashley jumping apparatus in his experiments with rats. This apparatus forces the rat to jump towards the discrimination stimuli. If the rat hesitates to jump it is shocked or a stream of compressed air is released at it. The conflict developing out of this situation caused a number of rats to become neurotic. The neurotic rats assumed the characteristic abnormal behavior of alternating between extreme restlessness and total quiescence. During the active period the rats ran hither and thither in a purposeless manner, being agitated by convulsions and tics; while during the passive period the animals slumped or retired into themselves and the experimenter could mould them into any shape without their showing the slightest resistance. The Morgans succeeded in producing experimental neurosis in rats by variations in sounds emitted by escaping air; while Humphrey and Marcuse used an electric bell to accomplish the same end.

Regarding the susceptibility of animals to experimental neurosis, the question arises as to whether animals, like humans, become neurotic as the result of the conflicts they meet in their environment. The answer is yes. Pigs, sheep, rats and mice, in their natural habitat, are not sufficiently restrained in their movements to develop conflicts that lead the neurosis. It is different, however, with dogs. These are often kept in close confinement, and as a result many of them become neurotic. This is especially true in cities where people live in a very narrow environment. Here the "living space," especially of dogs, becomes too small with the result that many of them become neurotic. According to a veterinary surgeon of Hungary, who keeps a nursing home for neurotic dogs in a suburb of Budapest, most city dogs are neurotic and subject to melancholia and depressions.

Of more interest than the induction of experimental neurosis into animals is the induction of such a state into human beings. Normal neurosis, that brought on by the conflicts of everyday life, to which people are exposed, is quite common; but artificial neurosis, that brought on by an experimental set-up of conflicts, is rare because our ethics frowns on the use of human beings for experimental purposes. There are, however, cases, reported by the Russian experimentalist Krasnogorski, of experimentally induced neuroses. For instance, a child of 6 was taught to respond with a motor reaction to a metronome beating 144 times per minute. When this conditioned response was well established, the experimenter varied the number of beats of the metronome. The child managed to discriminate between a metronome striking 144 beats per minute and a metronome striking 92 and even 108 beats per minute. But when the experimenter decreased the difference between the number of beats of the two metronomes still more, the child failed in its discrimination. The conflict became too great for it and it began to show symptoms of abnormal behavior. At a difference of 144 and 120 beats of the metronome, the child became taciturn, did not want to come into the laboratory any more, and adopted a slow purposeless gait. When the child was finally prompted to discriminate between 144 and 132 beats of the metronomes by responding to the former, it broke down completely and made the motor response indiscriminately to both 144 and 132 beats. The child now became excited, disobedient, rude, and pugnacious, on the one hand, and passive, sleepy, and generally inactive, on the other. In short, the child had become neurotic.

Although experimental neurosis was discovered in 1914, intensive research into its practical possibilities has only recently been undertaken. On the basis of the evidence thus far obtained, experimental neurosis seems to be of a primary importance in the study of how conflicts are formed, what the behavior consequences evoked by them are, and how these conflicts can be removed and normal behavior restored. The procedure consists of pitting against each other con-

flicting action tendencies. Such action tendencies are at work continually in our daily environment, but here they cannot be controlled by the experimenter. In the laboratory, on the other hand, these action tendencies are put under control. The experimenter can reduce or enlarge the strength of these tendencies, depending upon the urgency of the situation, and they can also be quantitatively measured by experimentally reinforcing the stimuli. This is impossible with a neurotic individual who has become abnormal as a result of the clash of natural action tendencies.

Meanwhile psychiartrists are reporting successes procured in the healing and re-education of many neurotics in our mental hospitals by applying the information gained as a result of experimental induction of neurosis into animals. Experimental neurosis can thus be regarded as one more method which may help to bring about the fulfilment of the following optimistic utterance made by Lowell S. Selling, author of the recently published book "Men Against Madness." Dr. Selling believes that "at the end of the next twenty-five years, more than half of the mentally sick persons admitted to our hospitals might be discharged as cured." Since there are about 600,000 mental cases in the U.S. alone, it would mean that, if Dr. Selling's prophesy comes true, the United States will have about 300,000 fewer mental cases 25 years from now, to the great enhancement of human happiness.

Blood Transfusion and the War

(Continued from page 26)

they are not universal donors. It means also a far greater supply of blood, which was previously one of the great difficulties of doctors working under war conditions. It is therefore evident that in plasma we have a fluid which is at least as good as, if not better than, whole blood for ordinary use, and which is definitely superior to whole blood for use in war.

Blood may be taken from donors expressly for the purpose of producing plasma. It is citrated to prevent clotting and left for three or four days undisturbed. At the end of this time the red cells have all settled to the bottom, and the plasma is simply drawn off into pint bottles, in which it is stored at 2° to 4°C. until needed. For transfusion purposes it is warmed to 37° C. (body temperature), and then administered by a similar process to that previously described for whole blood.

Although plasma may be stored and administered satisfactorily, Edwards and his co-workers thought that the problems of storage and transportation would be greatly simplified if the plasma were dried, and that the problem of bacterial growth would be reduced to a minimum. A method for drying plasma was brought forward in 1935. The plasma was frozen in carbon dioxide snow and evaporated under a very high vacuum. As this method required exceedingly expensive apparatus, it was never used to any extent. However Edwards and his assistants have recently devised an extremely simple and inexpensive method, using an apparatus which they call the continuous feed plasma drier.

The continuous-feed plasma drier of Edwards and his associates is diagramatically illustrated in fig. b. Bottles A and B are of 700 c.c. capacity. C. is a standard plasma bottle. H contains gauze, and G glass beads, both to filter the plasma. The drip at D serves merely to indicate the rate of flow. V is an ordinary valve fitted to a piece of rubber tubing in order to regulate the rate of flow. The glass tube from V into the bottle A is drawn to a fine jet at J. When the filter pump is turned on the plasma is sprayed finely into the bottle A from the jet J. As the plasma tends to froth up, the bottle B is necessary as a trap. Any plasma which froths into B will soon liquefy and run back into A. The water bath is kept at 37° C., and the valve is so adjusted that there is always a continuous film of plasma in the bottom of A. With the filter pump working continuously, the plasma is dried at about 100 c.c. per hour. Greater quantities may be obtained by setting up several similar sets of apparatus.

One hundred c.c. of plasma yield about eight grams of the dried product, which is crushed into a powder, so that it may be more quickly and easily dissolved when neded. It may be stored in bulk, or placed in conveniently sized ampules. The size of ampule at present being used in England contains sufficient material to dissolve in 250 c.c. of distilled water. Or this same quantity may be dissolved in 500 c.c. of a 5% solution of glucose. The purpose of this is to increase the volume of fluid administered in severe shock cases. The new dried plasma has not yet withstood the test of time, but it promises well, for no serious

(1) Edwards, Kay and Davie, The Preparation and Use of Dried Plasma for Transfusion. B. M. J., Mar. 9, 1940.

disadvantages of its use have yet been found. The reconstituted plasma is indistinguishable in appearance from the original product, and there is no reason to suppose that the dried product may not be kept preserved indefinitely. Stored in handy ampules, it is ideal for the surgeon's handbag, and more particularly for military use in advanced field stations. It has merely to be dissolved and filtered, and may be administered intravenously.

However, the use of dried plasma is, as yet, not very extensive, as it is the most recent development and will take some time before it will be accepted into general practice. The method employed in Spain during the Civil War was the indirect one, mentioned above. The blood was collected from civilians, citrated, and stored in central stations in refrigerators at 2° to 4° C. These blood refrigerators are known as Blood Banks. The blood is shipped by means of refrigerated trucks to any field-hospital or station where it is necessary. In England, shortly after the September 1938 crisis, the Medical Research Council began the establishment of an Emergency Blood Transfusion Service for London and the surrounding area. The region was divided into ten sectors with four main depots each capable of an output of 500 pints per day, and each with an enrolment of about 20,000 donors within three or four miles radius. It is of interest to observe that two of these depots were in full operation when war was declared at 11 a.m. September 3, 1939. Up to the present only Universal donors are accepted, but as pointed out previously, if and when the new methods come into general use, all those offering themselves as donors may be accepted. During the Battle of France a special fleet of aeroplanes was set aside in London for carrying blood to the front. Special crates, with provision for icepacking, were constructed. Each bottle was provided with sterilized equipment necessary for administration of its contents. However, all these provisions involve great expense, and it is thought that when the dried plasma method comes into general use, special aeroplanes, refrigerated trucks, Blood Banks, etc., will no longer be needed. due to the extreme convenience of the dried plasma ampule.

The struggle in which we are now engaged is on a far greater scale than we have hitherto experienced. Thousands of casualties may be inflicted in a matter of seconds, so the medical men must be always in the foreground endeavouring to save as many lives as possible. These men have at their disposal knowledge dating back to the beginning of our so-called civilization, and are using the most advanced and perfected methods of surgical and medical treatment, among which blood transfusion is one of the most important.

ACKNOWLEDGEMENTS

We wish to express our thanks to the following for their kind assistance in the preparation of this article:—

Dr. G. M. Dudley, Botany Department—Reading.
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Science--Freedom and Fact

Freedom is the primary necessity of Science and without it Science cannot flourish. Science must have freedom of speech, freedom of action, and freedom from political connection. This cannot always be obtained, and especially at present Science is being contaminated with political infection. A perfect example of this can be found in Nazi Germany. Here, Nazi scientists give scientific "proof" that the Ayran race is superior over all other races. These Nazis only show their ignorance since the term "Aryan" does not refer to any particular race, but merely to a language group that has evolved from ancient Hindu existence. This, then, implies that the lowest untouchable in India is of equal status to Goering, a fine example of a true tall, slender, blonde Aryan. And since it is a well known fact that the untouchables of India are a finer, more civilized group than the Nazi of Germany, the Aryan "fact" is sadly demolished.

Any debutante of America's first 400 would be dismayed to learn that the digestive processes that go on in her privileged body are no different to those that occur in the perspiring stevedore. Yet science has proven this to be a fact.

It is also a proven fact that should a Negro have the same opportunities as any individual of "God's chosen" white race, he would hold his own with the best of the Oxford graduates.

These are just a few of the scientifically-proved facts, and since the truth often hurts, scientific truth is often suppressed—thus explaining why Science lives on freedom.

Stuff 'N Things

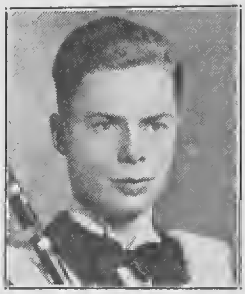
Senior Stick's Message

By LANGTRY LYND

IT is a rare privilege and pleasure for me to have this opportunity of extending to the freshmen, and any other newcomer to the Science Students' Association of the University of Manitoba. Linked with that welcome, is the hope that the freshmen and all other students will take the fullest advantage of the opportunity for all-round development given by University life, through extra-curricular student activities, including military training, and last, but not least (we hope!) through our various academic courses.

At a time such as this, students probably feel, and rightfully so, a more distinct responsibility for making the best use of their time, and for trying to be worthy of the investment the country is actually making that they may go to University. This session we are being given more opportunity to accept that responsibility, and fit ourselves for that capacity in which we may be most useful to our country and society. That is, whether eventually engaged in military or industrial pursuits, the time we spend in University, if used efficiently, will make us more capable of carrying out well whatever duties we may have later. So let us not think that the years at the University, although sheltered ones, are also unproductive ones, during which we are merely marking time before getting out into real life. The necessity for scientifically trained men and women during war-time when production must be pushed to the limit is obvious. Also, the very existence of a unit such as the C.O.T.C., is an indication that military authorities recognize University students and graduates as having special capabilities which make them good officer material.

The merits of the military training scheme for students have been well presented to us, and it is readily agreed that the benefits will be considerable. In order to gain these benefits, it will doubtless be necessary for all of us to cut down some on either academic work, extra curricular activities, or time out for amusement. However, by planning one's work properly, and by concentrative effort applied to the problem in hand at a given time, it should be possible to continue with very little left out of one's programme. Many of us students, perhaps most of us, spend enough time doing nothing, or next to nothing, to take care of considerable of the time required for study and assignments. I remember a speaker at a freshmen's gathering saying something like this: "Budget your time, and concentrate on what you're doing — don't dream about the last dance you were at, when attending Chemistry lectures, and, about all, don't dream about Chemistry when at social functions. In short, organize your work, concentrate on one thing at a time, and the more you try to do, the more you'll be able to do." I think that is good advice for all of us, not only for freshmen.



Langtry Lynd
Lantry is a Fifth Year Honors student taking Chemistry and Geology and majoring in the latter. He is a gentleman who plays fair and square and if anybody is well-suited to the task of Senior Stick, Langtry is.

Which brings us to the place where you all—that is, anybody reading this—should be convinced that you can find time to take part in the activities of the Science Students' Association. One can still get the best out of his course, and at the same time develop other interests and qualities which can play just as important a part in one's experience as the actual academic work. In fact, prospective employers will want to know not only how much education one has, but also, what else one has done besides attend classes, study, and have a good time. Extra-curricular activities are recognized as being important in developing initiative, a sense of responsibility, and co-operation with others. All this is in addition to the pleasure and satisfaction derived from the activities themselves, and from associations made with other students.

I wish to make clear, to the freshmen in particular, that a wealth of experience is

(*Please turn to page 46*)

An Ecology Field Trip

By BETTY BROWN

UNFAVOURABLE weather conditions had rendered necessary cancellation of a previously arranged ecology field trip. But the clouds on this occasion, as always, held a silver lining, for morning of October eleventh — the postponed date, broke clear and beautiful.

We couldn't have wished for a better day; there wasn't a cloud in sight. The sky was the blue of the stratosphere (typical of our autumn skies in Western Canada), the trees and shrubs presenting a varied pageant of colour, and the atmosphere clean and exhilarating. The assembly was at the Broadway Buildings where scores of beaming freshmen made ready for their gala day, complete with yellow and green freshmen caps, all bubbling with enthusiasm. One suddenly felt at least ten years older, no longer a frivolous freshman, or even a care-free sophomore, but a sedate and serious-minded senior. Alas, how "Time rolls his ceaseless course!" But to our tale. The clan had gathered by nine forty-five (under the supervision of Dr. McLeod, our instructor), equipment had been loaded and we were buzzing along the broad highway, surrounded by a glorious panorama of autumn colours.

Betty Brown
Betty is taking a Fourth Year Honors Course, majoring in Botany and Zoology. Betty is one of these zoologists who makes life miserable for animals whose only crime is that they are lower n the taxonomic strata of life.

A number of environments are visited on these trips, "for the purpose of making a general survey of animal habitats and to provide an opportunity for comparing various environments." Each individual pools his acquisitions, i.e., notes, sketches and specimens (the latter with which he is sometimes reluctant to part). These are collectively used in the preparation of a final report.

We arrived at Matlock "suburbs" around eleven-thirty, where in spite of gnawing hunger from which several members of the party were already suffering, equipment consisting of vials containing alcohol, insect nets. etc., was unloaded, and the party set out in small groups to make a brief journey before lunch.

Our group of three examined some mud-flats along the lakeside, where were found several frogs (Rana pipiens), Caddis-fly larvae (Trichoptera) and numerous clams (Anodonta). Along the shore, a variety of snails, Physella, Stagnicola, Heliosoma, Amnicola and Planorbis were found, while back from the lake on a flood-plain, specimens of Diptera (Tipulidae), ants (Formicidae) and dragon flies (Odonata) were identified.

Starvation for the party seemed in the circumstances a remote possibility, having visions of simmering frogs legs and clam chowder, and perhaps fish for dinner, if the day endured. Specimens acquired were bottled and a speedy return to cars was made by the ravenous band. Soon a cheery fire was burning and with the assistance of our good friend, Miss Anna Bredt, "the feast was set and the guests were met."

It was indeed glorious looking out upon the broad expanse of blue water, shimmering in the brilliant autumn sunshine, crickets chirping nearby and gulls circling overhead. Before long our hungry band of ecologists had consumed a sufficiency—perhaps over-sufficiency—of carbonized weiners, doubhnuts, apples and coffee. Our photographer (Miss Marie Baragar), then took a few "profile shots" of the environment while we jotted down some random notes of our morning's discoveries.

Equipment was then packed and the party ambitiously pushed on toward Netley Marsh, a few miles distant. Here at the edge of the swamp. subterranean organisms were collected by digging an area of about five or six inches deep and one foot square.

The following were found: Snout beetles (Circulionidae), pupae of fall Canker worms (Nocturidae), along with spiders, mites and a lone cricket. Some samples of soil were scooped into containers, later to be "washed" for specimens in the laboratory.

(Please turn to page 47)

Education Here and Over There

ROSEMARY TOWNEND.

AS a comparative newcomer to Canada, I do not consider myself fully qualified to write about the educational system of Winnipeg, about which I know little, and I must ask to be forgiven for any misstatements that I may make.

In Winnipeg there is a system of education which at first seems ideal, since the public schools give everyone an equally good chance to get an education; but beneath the surface it, too, has its disadvantages as does the English system. In England good education is unfortunately restricted to the more wealthy people and those who can manage to obtain scholarships; while the poorer classes get little more than the minimum requirement. One of the chief faults with a public school system is that the standard of the more clever pupils is inclined to be lowered to the average. This is the natural result of the large numbers in the grades which make individual attention difficult. We have the same difficulties in the English "High" and "Grammar" schools, which most nearly correspond to your public schools.

These High schools are not the same as yours since they are not restricted to a few grades only. They are run usually by the local county councils and have a small fee. Similar to these also are the elementary schools which are for those who can afford no fees. The teaching in these is not of a high standard Unfortunately many of the pupils leave school at about fourteen, because they have to obtain work as early as possible.

There are, however, some students who are keen enough to do some studying on their own, and whom this bare education does not affect much. The great advantage of the Winnipeg public school system is that these people do become properly educated regardless of their means.

The most common type of school in England is what you would call a private school, which, for some reason unknown to me, is called "Public" over there; an extreme example being Eton or Harrow. These schools are all run in the same fundamental way though they differ in detail. They have high fees and so can afford all the facilities of higher education. The forms are smaller and towards the top of the school, when the boys begin to specialize, they have only one or two masters. These become well acquainted with the boys, and can draw out their individual talents. That is the true meaning of education, to draw out. These masters are entirely responsible for the boys' education and do not have to confine the English lesson to English, but can overlap into history or geography, as they think fit. Thus, although we may specialize earlier than you do, we still get a "general" education.

The majority of the English "public" schools are boarding schools. Although the boys live in dormitories, they get some privacy, especially when they become seniors and have studies of their own. One of the advantages of boarding schools, especially among the juniors, is that homework is overseen. It has to be done at a certain time, so that it does not become such an effor as when there are other distractions. Another advantage is that the children, being away from their parents for some time, learn independence (although some people do not think it right for them to be separated).

There are very few co-educational schools in England, except for the elementary schools. The girls' schools are run on much the same lines as the boys.

The standard of education varies from one school to another in England since there are no annual public examinations. The first public exam. of an importance is the School Certificate, and even that varies according to which board of examiners sets it, Oxford, Cambridge. London, Oxford and Cambridge joint board, etc.

A very small percentage of people go to the Universities in England, mainly because of the high fees. London University is more comparable to the University here since it does not constitute the main part of the city as does Oxford and Cambridge. Most students have a year or two after matriculation before going to college, and so first year here is the equivalent of third year there.

In England we start French and Latin much earlier than is done here. We start with a large number of subjects and drop some after Matric, when we specialize in the subjects which will be most useful for our careers. In Winnipeg you seem to start with a few subjects and add on as you go through school, which promotes a general education.

(Please turn to page 47)

Sports

Preview, 1940-41

THIS year our Athletic President is Sol Prasow. Everyone knows Sol as he has been around the campus for at least four years. He is an energetic worker who usually accomplishes what he is after. He, already, has been instrumental in bringing us two championships. So, if Sol receives the support of the students, I predict a banner year in athletics for Science.

Our Athletics Council for the year consists of the following:

Track—Shia Cohen.
Soccer—Bruce Jones.
Tennis—Harvey Parkhurst.
Basketball—Ken. McKenzie.
Hockey—Harold Sigurdson.
Curling—John Knox.
Swimming—Stan. Caha.
Fourth Athletic Representative —Tim Jacobs.
Third Athletic Representative—Art Cowan.

Second Athletic Representative — George Bevin.

First Athletic Representative—Teke Ferley.

The main work of the council is twofold; to create interest in their particular sport and to award deserving participants with letters.

Our track team has given us a good start by copping the Interfaculty Crown. This is the first time that Science has won this coveted honor. Led by Les and Shia Cohen the team amassed a total of 60 points, more than doubling the total of the second place team. The squad was evenly balanced and although the individual awards went to Shia and Les they were ably supported by a brilliant array of talent, namely: Bruce Jones, Cam Mann, Phil Cramp, Greg Haines, Bernie Fingard, Art Cowan, Stan. Caha and Don Girourd. Quoting Harvey Dryden, of the Manitoban, "Science is overconfident, United is a cinch to win." We would like to ask Harvey if the United team knew where Sargent Park was that day.

Science's second trophy—The University Tennis Cup—was won by Alec Miles (again). Miles defeated Leyden, of Arts, in the finals. Of the four 'Varsity semi-finalists, three were Science Students — Alex Miles, Sol Prasow and Sam Boroditsky.

In the soccer team ably led by Bruce (Whimpy) Jones, lost only one game to the champion Aggi team. Some of the better performers were Gordon McKay, Harvey Parkhurst, Wilf Fraser and Stan Caha.

'Varsity's entrance into the Junior League, necessitated the cancellation of the Interfaculty schedule. Some of the Science men who made the team were Bob Holiday, Dave Herstein, Jack Iverson, Archie Gray, Steve Campbell, Bill Smith, Rube Ludwig and Greg Haines. The last two mentioned were named on the Junior All-Star team. Ludwig, captain of the team, was the bulwark of the line. Haines is my choice for the most improved player on the team. When 'Varsity was trying for a play-off berth, he was one of the brightest offensive stars. So—hats off to Gray and Rube.

We should all be looking forward to the major winter sports, namely, hockey, basketball and curling. With good support from the student body, we hope to win two of these championships.

In conclusion—let us all co-operate with Sol and his Athletic Council and make this a year of championships for Science.

Science Women's Athletics

By DIANE LORANGER

SCIENCE girls are gradually finding their place in University athletics, and in the last two or three years have shown great improvement. This is due in no small part, to the greater enthusiasm shown in Junior Division. At present we are taking part in all branches of sport that the University offers.

A track team was entered in the Interfaculty meet, held on Freshman Day, which showed great promise by holding down second place for some time but were forced out in the last few events. We are looking forward to great things in the future with enthusiastic girls like Elaine Felstead, Rose Mary Townend, Marian Gowan, Peggy Moorehead and Winnifred Ross on the team.

Diane Loranger
Diane is in Third Year Science and is a member of the Science Council, being the Women's athletic representative. The girls in Science have a satisfactory athletic rep. in Diane, since she is no mean athletc herself.

Interfaculty basketball has been cancelled by the U.M.S.U. Women's Athletic Directorate this year in order to concentrate on 'Varsity basketball. In it's place the Y.W.C.A. have offered a combined gym course of swimming and dancing. More than a dozen girls have taken advantage of this instruction.

We hope to enter a swimming team in the next term, and, judging by the performance of some of our girls down at Sherbrook pool, we can count on a team that will give the others some lively competition.

Last year considerable interest was shown in badminton, and although there is no interfaculty league we would like to see you all down at the University Badminton Club.

Mixed bowling has been under way for some time now and is being well supported by the girls.

Two years ago the Science hockey team captured the Interfaculty competition cup and this year we are out to regain it. Most of last year's players were inexperienced, but with a year's playing behind them we are expecting them to put up a good fight.

A great deal of credit for the standing of our hockey team the last two years is due to the capable coaching of Mr. J. T. O'Brian, who, we hope, will be back with us this year.

The Science Woman's Athletic Council is anxious to have all students who are interested in any branch of sport, contact some member of the committee as it is only by your wholehearted support and co-opera- the Green and Gold colors in their proper place. So let's get together and make this an outstanding year in Science Athletics.

Sports Representatives—

Third year—Winifred Ross.

Second year—Isabelle Kippan.

First year—Grace Musker.

Hockey—Jocelyn Robb.

Curling—Florence Stirling.

Badminton—Winnifred Ross.

Swimming — Winnifred Ross, Isabelle Kippan.

Bowling—Kae Stevenson.

WE WANT TO KNOW

Why human beings with their inherent pseudomoral beliefs insist in hushing topics pertaining to veneral diseases, and humble themselves before moralists? If these socially-condemned diseases were received with opened and unbigoted minds and with increased medical education, together with state control, syphilis and gonorrhea would pass out with the horse-and-buggy. Why not forget the ancient idea that man must suffer for his sins, and realize that the blame lies upon crooked little Spirochaeta pallida, who is after all merely a member of the genus which contains Sp. duttoni, the badboy of relapsing fever. Please remember that little Paul Ehrlich didn't prepare six hundred and six compounds merely to wile away the time.

Science Ladies' Club

By ILEEN STODDART

THE women of the Science Faculty have planned and already enjoyed part of, a lively program of social events. With a record registration of freshettes, an intensely loyal (faculty spirit and capable, energetic leaders, the Ladies' Club is looking forward to a very successful season of activities.

Science freshettes were first entertained at a Coffee Party, Saturday, Sept. 14, in the Junior Division Common Room. Marie Baragar, Lady Stick, and Peggy Kennedy, Junior Lady Stick, received the newcomers and the bewildered freshettes were introduced to the officers of the Ladies' Club and the senior girls. Mrs. Leach, honorary president, poured tea which the uninitiated served. The freshies had a chance to discuss courses and subjects not yet fully understood with their more experienced sponsors. The Coffee Party proved a splendid, informal manner of making the freshette feel the scope and responsibilities of the faculty into which she was entering.

The familiar strains of:

"Way up the river we will
Row! row! row!"

were heard by many riverside residents of St. Vital and Fort Garry on Saturday, September 21. Upon investigation they would have seen a great flotilla of canoes and rowboats slowly and painstakingly making their way upstream. The Science Women were on a canoe trip! With guarantees that "the river wasn't really very deep" even the rank amateurs tried their hand at the paddles. Landing was accomplished some distance up on the Fort Garry shore where hot, hungry girls fell to on cakes and hot dogs. When stomach pangs were satisfied, the freshettes were taught the proper (and improper) Science yells and songs in the course of a lively sing-song. Mid-afternoon found these songs echoeing to the passing shores as:

"Back down the river they
Rowed! rowed, rowed!"

The climax of Faculty affairs for the Freshmen came on Oct. 9 when Science men and women-to-be were formally initiated into the secrets and customs of the "Question Mark Faculty." The Ladies' Club completed a day of braids, placards and green ribbons by a banquet at Liggett's. Accustomed to the civilized uses of fork and spoon most freshettes found soup and spagetti rather difficult to balance on a knife. Antics and tasks of every embarrassing sort were "cooked up" by amused sponsors who still held very dear memories of their initiative days.

Back at Broadway, amid the solemnity of darkness, candles and black gowns the oath-taking was given. At last the freshette was really "in."

An evening of dancing at Fort Garry, provided by the men, completed a head-line day. We do hope it proved one which none concerned will forget; even long after they can sign their B.Sc.

By the time this publication goes to press the Ladies' Club will have enjoyed another event—the party planned for Saturday, November 23. An afternoon affair, it will be held at the home of Mrs. A. E. Floyd, Norquay street. Freshettes of first year are presenting a skit of yet unknown character or cast. The surprise of the party is an original melodrama to be presented by fourth year grads. Understood in secret quarters to surprise "Stage Door" it is expected to command repeat performances and live on down in faculty history. Being the first regular meeting of the year it is hoped it will set an example of attendance and vigour for following events.

The faculty reception to be held Nov. 30 defintely does not come under the Ladies' Club's activities, although the Science women are essential to its success—what would a tea be without that feminine touch? A common complaint of many students is that they seldom become acquainted with their Professors on any better terms than "Good morning" and "Good night." The faculty reception is planned definitely for the purpose of bringing the staff and the students together under sociable conditions to become better acquainted. The faculty on the whole is really interested in the young men and women whom they teach, and it is hoped the student body avails itself of this opportunity to entertain the staff and to increase the fine spirit of friendship existing now.

No definite date has been set for further Ladies' Club activities, although a Xmas week party is expected after Junior Division

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The Book Review

Edited by MARIE BARAGAR

When the 1939-40 Science Students' Council came to look over the year's financial status they found, much to their surprise, a surplus of two hundred dollars. After a lengthy debate they decided to adopt Mr. Lorne Duncan's suggestion of buying books for the Science library.

The money was then divided among the different Science departments which were to submit a list of ones they would suggest to a committee consisting of Mr. Lorne Duncan, Senior Stick; Dr. H. H. Saunderson, Honorary President; Miss Doreen Allison, Lady Stick; Mr. George Acheson, Treasurer, and Mr. Lantry Lynd, the Senior Stick for the next year. The only restriction being that they were to be Science books for the use of undergraduate students. These are not as yet in the library, but they are expected to be in shortly after Christmas.

The following review is to give the student some idea of what these books contain and what classes are likely to use them.

The following review of the Physics department list was prepared by J. Humphreys:

"The Theory of Atomic Collisions," by N. F. Mott and H. S. W. Massey. Oxford Press 1933.

This book, the 6th Volume of International series of Monographs on Physics, gives a very complete account of the applications of classical and quantum Mechanics collisions between atoms, electrons and ions. The writers have played an important part in the development of the theory of collisions, and this colume contains much published and unpublished work due to the authors and their colloborators. While this book is primarily theoretical in outlook, experimental work is discussed in detail and the comparisons of practical and theoretical works are an essential feature.

The early chapters prepare the reader for the general theory in Chap. VIII. Some Wave Mechanic Theorems and it is shown that only in a Coulomb field is the wave mechanics in agreement with classical theory. This is followed by a chapter on electron spin and a discussion of collision between identical particles.

After the general treatment in Chapter VIII, several chapters are devoted to collisions between electrons and atoms. Elastic collisions are discussed first, then the validity of Barn's approximation when considering collisions of fast electrons; of the necessity to take in the distortion of the electron wave for medium velocity electrons; and the exchange effects for slow electron impacts. It shows that the theory of inelastic collisions is in accord with experimental evidence, but that of slow electrons is purely qualitative.

It discusses the collisions of electrons and molecules and gives some problems in Kinetics. Methods for the calculation transition probabilities between two states, all of which is quantized, and finally a relativistic treatment of the two.body problem are given together with the account of the calculations of a nuclear field from anomalous and particle scattering.

This book should interest those working with collisions for the theorist will appreciate the mathematical methods and their developments, while the experimenter will find the numerical results of considerable value.

Source—Vol. 18, July, 1934.—No. 117 of the "London, Edinburgh & Dublin Philosophical Magazine and Journal of Science."

"Applied X-Ray," by George L. Clark.—Professor of Chemistry at the University of Illinois.—McGraw-Hill.

This is the third edition of this book and the author, besides bringing it up-to-date, has expanded his material to cover the developments of the past eight years.

The book has retained its original purpose of presenting X-rays as a research and now covers many of the new industries as well as the complet e field of science.

Far greater care has been taken with its interpretations and with its detail. The chapter on interpretation of X-ray diffraction patterns is entirely new and presents a concise and complete treatment of that subject. New chapters have also been added on measurements, photochemistry, biological effects, structures of minerals, glasses, liquids and polymers. The new plastics, Nylon, synthetic rubber and polyvinyl derivatives are also discussed. A summary of the knowledge of some of the older plastics has been included as well as about 340 illustrations of good quality.

Source — "New Book Announcements." McGray-Hill publishers.

"Phenomena of the Temperature of Liquid

Helium," by E. F. Burton, H. G. Smith and H. O. Wilhelm.

Many surprises regarding the behaviour of matter at temperatures approaching absolute zero are revealed in this book. For example, some metals of very low conductivity at ordinary temperatures become infinitly conductive at 1°K. The exploration of this little known subject is one of the most fascinating and important fields of modern physics.

It is of the greatest importance for both physicists and chemists to be familiar with the action of matter at excessively low temperatures. This book discusses the means of producing and measuring both the temperatures and the properties of the material as well as a general presentation of experimental results already obtained. This is given early in the book.

The essence of the book is in the latter half which deals with the impact of curious low temperature phenomena on modern theories of matter, the nature of superconductivity, the behavior of specific heats and magnetic properties of matter and the freakish antics of liquid helium. Particular attention has been given to the definition and measurement of temperature and to the intreguing problem of the approach of absolute zero.

The experimental work for this book was performed in the McLennan Laboratory of the University of Toronto, one of the best equipped physical labs. in the world. The authors are pioneers in low temperature work and their book should be of great interest.

Source—The Reinhold Publishing Corpn. review.

"In troduction to Electricity and Optics," by N. H. Frank.—McGraw-Hill.

This book is not intended for general college use and the reviewer felt that it had been so thorough and so condensed to the basic essentials as to leave a non-science student wondering where it could possibly fit into the scheme of things. There is no discussion of application or experimental method. The reviewer also felt that it would be a welcome change from the modern trend to say more and more about less and less with the only knowledge gained to be vocabulary.

The text opens with electrostatics and leads naturally to current electricity, displacements current, to Maxwell's equations. A slight degression enters here into conduction in a vacuum, then dielectrics and finally electromagnetic waves in material bodies constitute the electrical part of the book.

The light section treats lens, apperation, dispersion, scattering, interference and diffraction. A chapter on heat radiation completes the book.

A few of the good points are: a good description of the units to be used, including the newer M.K.C. and the older c.g.s. units; are of the best expositions of B. and H.; and fundamental differences rather than similarities of magnetostatic and electrostatic fields.

Each chapter is concluded with a list of problems, some 340 in the book.

Obtained from D. H. Laughbridge's review in "The Review of Scientic Instruments" of October, 1940.

Eight new books of special interest to the student of chemistry are included in the list. For those interested in aniline dyes and their intermediates there will be: **"Synthetic Dye Stuffs,"** by Cain and Thorpe (Griffin & Company publishers). This is an

In Memoriam

CYRIL B. MILLER

HONORS CLASS OF '41

DIED

OCTOBER 9, 1940

up-to-date reference book for Fifth-Year Students.

A revised edition of a highly successful manual will be found in Shriner and Fusons' **"The Systematic Identification of Organic Compounds,"** 1940, (John Wiley & Sons, Inc.). This manual contains descriptions of new derivatives and compounds as well as methods far preparing the derivatives and special laboratory precedure. This will be used as a reference book in Fifth-year organic classes largely for directions for the quick preparation of derivatives of unknowns.

Mellon's "Chemical Publications"—Second Edition ,McGraw & Hill), is an up-to-date guide on all Chemical literature that has been published in magazine or book form.

"The Terpenes"—Vol. II, by Simoason, is a completion of Volume I. It discusses the bases of perfumes and such compounds as the camphors and thus is of general interest, although it will be used mainly by Fifth-year students.

In the field of inorganic chemistry there are two excellent reference texts which will be useful to the beginner as well as to the advanced chemist. The first is **"A Reference Book of Inorganic Chemistry,"** by Latimer and Hildebrand (McMillan). The second is "Inorganic Chemistryy," by F. A. Phelbrick (G. Bell, publisher).

B. S. Hopkin's **"Chapters in the Chemistry of the Less Familiar Elements,"** (Stipes, publisher), deals with the elements which are not used very extensively in industry and are thus not as well known. For example he deals with the rare earths, rubidium and cesium.

The last book of the chemistry series deals with the atomic structure on the basis of electronics. It is **"The Nature of the Chemical Bond,"** Second Edition, by Pauling (Cornell University Press).

Nine books make up the list from the Geology department which have been reviewed by Mr. Israel Spector.

The first is **"Geology of South Africa,"** by Du Tait. As the name implies it deals with the latest data of the geology of that country and will be used mainly for reference.

One, the economic side of the field is the special paper of the Geological Society of America. **"Contributions to a Knowledge of the Lead and Zinc Deposits of the Mississippi Valley,"** which, because of its advanced nature will be used on the graduate course.

For those interested in research there is Grant and Schwartz, **"The Anorthosites of the Superior Region,"** published by the University of Minnesota Press.

L. B. Robert's **"Topographic Mapping,"** practically explains itself. It is for use as a general reference on any mapping course.

The latest Laboratory manual on petrography is by Rogers and Kerr, called **"Thin Section Mineralogy,"** published by McGraw-Hill and now available at the University Book Store, Broadway.

New data on historical geology is contained in "Textbook of Geology," by Schuchert and Dunbar, while of interest to all is the historical biography of **"O. A. Marsh—Pioneer of Palaeontology,"** Schuchert and Levine. O. A. Marsh was one of the first to popularize work on the dinosaurs.

Then of interest to the researcher is the book on **"Elements of Optical Mineralogy,"** by Winchell & Winchell, which is in three parts.

The last is **"Earth Sciences,"** by J. H. Bretz, which deals with the orientation courses.

Senior Stick's Message

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not necessary in order that you may help on any of the Science sub-committees, or take part in any athletic, debating, dramatic, or social programme.

Each year has a representative on each sub-committee, and from that representative any student can find out how to help any activity where his interest may be.

The social programme is somewhat curtailed as compared with two or three years ago; owing to the inadvisability of holding large public dances, there will probably not be a dance in second term on the same scale as the old "Waltz-Prom.," but provision has been made in the social committee budget, to hold more small class parties, these having been so successful last year, and also, so far this year.

Other sub-committees are carrying on as usual, under quite capable heads. I have found this year's council to be an efficient and hard-working one, co-operating in an excellent manner. With the whole Science Students' Association behind the council, we will definitely have an enjoyable and successful year ahead of us.

Education Here and Over There

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However this appears to prevent you from doing any specialization until you reach third or fourth year university, and means that you have to keep on subjects which may be of no use later on.

I do not think that it would be a misstatement to say that the English student at school do not do as much work as those here. They are given so many hours per week prep. for each subject and do about two hours a night. Here it seems that a prep. is given for each subject had during the day, with the result that the students gets tired and does not absorb as much as if he did less work. Coupled with this is the fact that there seems to be much less exercise which rests the mind from books for a while, as well as keeping the body healthy. In England most schools have an hour's exercise a day, added to which is a period of gym, or swimming in the summer, twice a week. Our holidays are arranged differently also. We have eight weeks in the summer, from the end of July to the end of September, four weeks at Christmas and three at Easter. This has its disadvantages in that we have to work through June, but we do not usually have to deal with such hot summers as you have here.

I think that a very good educational system would be a combination of your public schools and our system. A public school with smaller forms, less homework and more recreations would yield a higher standard, and I do not think that the last two propositions would be unpopular with the pupils.

The most beautiful thing one can experience is the mysterious. It is the source of all true art and science. He to whom this reaction is a stranger, who no longer can pause to wonder and stand wrapt in awe is as good as dead, his eyes are closed.

—Albert Einstein.

Assymetry, the only distinct line of demarcation which we can draw today between dead and living matter.

Louis Pasteur.

When statesmen, politicians and others of the ruling ilk will realize that Science is international, knows no race, nor creed, nor color, and desires to serve only the species, sapiens of the genus, Homo.

An Ecology Field Trip

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Another stop was made near Clandeboye. Here were examined animal aggregations of old fallen logs and dead tree-trunks. Passers-by seemed somewhat bewildered by the sight of enthusiastic ecologists, rolling over logs, climbing stumps and industriously stripping bark from tree-trunks. The collective bag consisted of rove beetles (Staphylinidae), beetles, ground beetles (Carabidae), two flea beetles (Chrysomelidae), leaf hoppers (Cicadellidae), as well as grasshoppers (Dissosteira carolina), wasps (Vespidae), and Phalangids (Phalangidae).

Most members of the expedition were at this stage pleasantly fatigued, which state seems to make for the pensive mood. Gazing towards the west, the lines of Keats recurred to mind—

"While barred clouds bloom the soft-dying
day,
And touch the stubble plains with rosy hue;
Then in a wailful choir the small gnats mourn
Among the river shallows, borne aloft
Or sinking as the light wind lives or dies." . .

Science Ladies' Club

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has finished the ordeal of examinations. Likely to be skating, hiking or tobogganing, it would be one holiday activity all Science girls could look forward to.

One of the most worthy and necessary characteristics of any society is enthusiasm. This spirit seems to be imbedded in the makeup of most of the Science girls to a maximum degree. Evinced in their spontaneous agreement to participate in all fields of Faculty or University affairs, it has given the minority that we are, a place equal with the best. Sports, dramatics, music, or scholarship are seldom without a fine showing of Science participation. May this spirit continue to be the leading virtue of our organization. May this spirit continue to carry accompaning success wherever the girls of the "Green and Gold," turn to united efforts.

When the fruits of medical research will contribute to human being equally regardless of their economic brackets.

"I would rather suffer for speaking the truth than that the truth should suffer for want of my speaking."

The Unit System

The one accursed thing existing in this University is the persistent occurrence of the Unit System. This is the system by which every student of the University must necessarily take a certain number of credits for a year's work. That is, in a Senior year, the student must take **16 units,** and not only must he take other definite number of units, but he is also restricted to what subjects he should take. Because of these rules, many idiotic situations occur. Thus in one case we may have a student who is majoring in Chemistry, waste valuable time in studying the habits of **Dissosteira carolina,** the grasshopper.

In another case another student may be studying bacteria cultures, when he should put more time on mineral identification.

It can be understood that certain sequences and combinations should be observed. That is, students majoring in Physics should have all the mathematics they can get. The unit system allows for this, by giving eight units to each subject in the Honors years. But suppose a student is majoring in Chemistry. He also needs mathematics but could do with a course on physics besides. There is no allowance for three subjects to be taken in the Honors years.

This year, however, a few students **are** taking three subjects in their Honors course.

This permission was obtained only after exhaustive appeal to the proper authorities. Two subjects still remain on the legal course, however.

It is conceeded that some sort of a unit system should be applied to the Junior years, for without a definite system chaos would certainly result. However, changes can also be made in these primary years. That is, if a student were intending to major in chemistry, he should get more chemistry, more physics, and more mathematics in his Junior years, and less of the other subjects which he definitely does not need. By doing away with these other subjects the student would be able to receive increased laboratory experience.

This year the University took a well-directed step forward with the introduction of a Reading Course. In this course a student is given an alloted time in which to hand in to his professor, an essay on some chosen topic of his work. This essay idea gives the student practice in library research which is a definite prerequisite for any student who plans to take post-graduate work. The student will thus acquire the technique of choosing the right material and planning his report in the proper manner.

It has been argued that Science students should take English, since this would help them in the writing of scientific reports. This argument is false. All the student obtains in his English course is out-dated styles, flowing poetry, or civilized thought of various centuries. The Science student does, however, need some experience in writing, and this can be obtained by the newly established reading course; for here, the student will study many scientific reports written in the manner necessary, and not in any emphasis or metaphoric style.

The defenders of the unit system insist that the aim of a Science course it to give the student a **general** knowledge of science. Thus the student by the time he obtains his Pass degree will have studied Chemistry, Physics, English, German, Botany, Zoology, Geology and Mathematics. But the fly in the ointment is that if you ask any honest student what he has learnt, he will reply in all seriousness:

"Nothing!"

And this is the actual truth of the matter. The conscientious student will sit and wonder why he should have a B.Sc., because how desperately he may try he just can't remember all those things that he knew before the examination. He only has a smattering of knowledge of the entire course which is worse than if he hadn't known anything.

One may argue that nevertheless a University education has given the student something which puts him into a niche that others without University education do not occupy.

So what? What is the use if the student has only nipped into the realms of chemistry or physics? That is not learning the sciences.

Thus, it is desired, at least, for future science grads, that the University will finally evolve to the stage, where B.Sc. will really stand for Bachelor of Science and not for Bloated Scholar.